THE

CIVIL ENGINEER AND ARCHITECT'S

JOURNAL.

SCIENTIFIC AND RAILWAY GAZETTE.

VOLUME VI.—1843.

LONDON:

R. GROOMBRIDGE, 5, PATERNOSTER ROW, J. WEALE, 59, HIGH HOLBORN; WILEY & PUTNAM, NEW YORK: GALIGNANI, PARIS.

PRINTED FOR THE PROPRIETOR BY THOMAS BURROWS, AT THE OFFICE OF THE CIVIL ENGINEER AND ARCHITECT'S JOURNAL, 10, FLUDYER STREET, WHITEHALL.

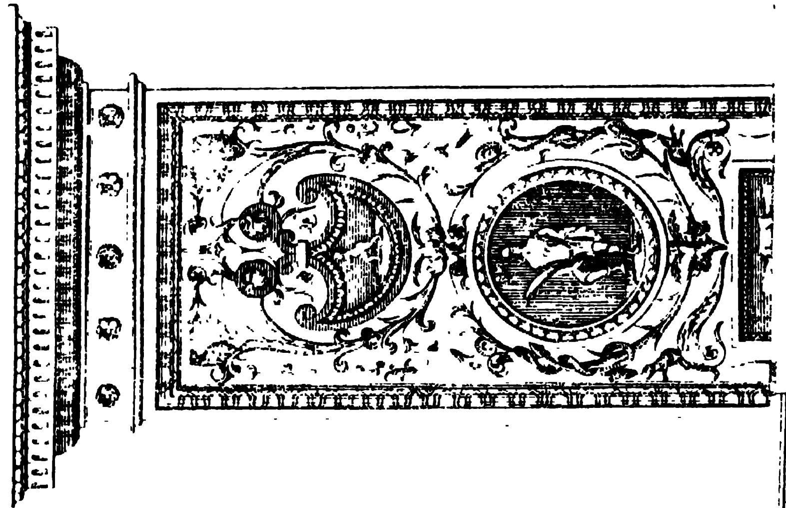
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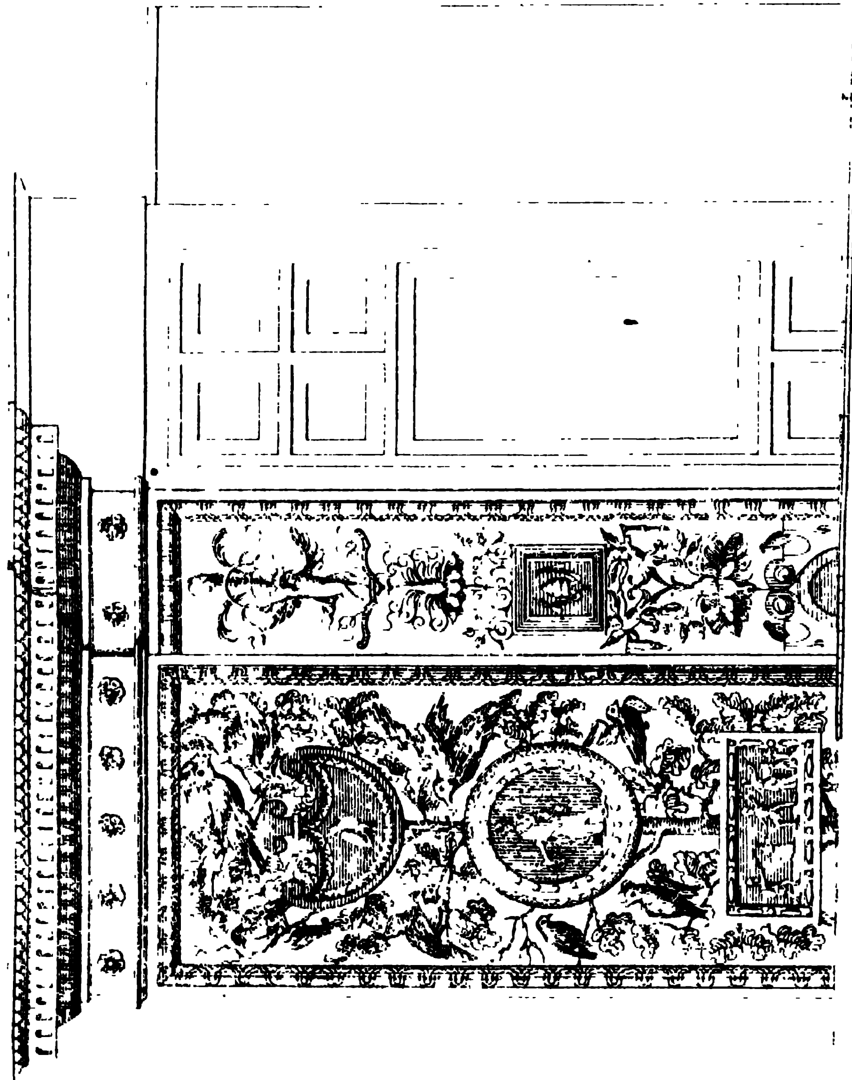
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THE CIVIL ENGINEER AND ARCHITECT'S JOURNAL.

REMARKS ON ARABESQUE DECORATIONS, AND PARTICULARLY THOSE OF THE VATICAN.

(With an Engraving, Plate I.)

Read at the Institute of British Architects, February 3, 1840.

[At a moment when the public attention is so greatly occupied with the revival of decorations in fresco painting, we have much pleasure in being enabled to lay before our readers, on the commencement of a new volume, the following paper, originally produced at the Institute of British Architects. We regret that we cannot devote a larger number of engravings to the illustration of this essay, which must consequently appear somewhat defective in form.]

It is an observation which has been very frequently repeated and very variously expressed, that the proper use to be made of the study of the ancients in their works of art, is not to copy, but to endeavour to think like them. It is admitted to be of little utility to the artist, to imitate the forms of those beautiful models of decoration, which the Greeks and Romans have bequeathed to us, unless at the same time he qualifies himself to apply them judiciously, and modify them successfully, by investigating the principles from which they originate. Among these principles, none is more important, or has exercised a greater influence in bringing ancient art to perfection, than that which has been so well condensed into one line, that

"True art is Nature to advantage dressed."

and if we wish to rival the ancients in the production of what is at once excellent and original, we must, like them, seek the original types in the works of Nature. This was the source from which they drew the various objects which they have modified and combined, not only in their capitals, their friezes, their vases and their furniture, but also in the apparently capricious and fanciful mixtures of different species of animals, and even of foliage and animals, into harmonious compositions, which delight the eye by their graceful and elegant forms, however repugnant to truth, or incompatible with reason. The motives are to be inquired into which influenced the choice of these objects, and the process investigated, by which they fell into the conventional forms in which alone many, perhaps most of them, are now to be found.

That such a course of study would be analogous to the practice by which the ancients themselves attained so high a reach of perfection, we have sufficient proof. Nothing in art can be imagined more conventional than the orders of architecture; and yet Vitruvius endeavours to derive them all from simple principles, and in the Doric order, we can easily trace the original elements of a primitive mode of construction. We shall not so readily perceive the analogy with the female form, given as the origin of the Ionic. It requires a very great stretch of imagination to refer the volutes to the curls of the hair, or the flutes to the folds of the garment. Whatever be the origin of the Corinthian order, the fable which attributes its invention to Callimachus, is as graceful as the order itself; and its repetition by Vitruvius sufficiently indicates it to have been a received principle, that the most conventional forms (and a more conventional form than the Corinthian capital it would be difficult to point out), were supposed to have been originally suggested by the forms and accidents of nature. The least we are authorized to infer from all these instances is, that in the opinion of the only ancient author on architecture to whom we are able to refer, a motive was to be found in every thing the ancients invented, and that in studying the arts it was indispensable to seek and to understand it.

To follow up the subject of these remarks, would open an extensive field of inquiry. They are offered in the present instance merely as prefatory to a few observations on the arabesque style of decoration, illustrated by a short review of the arabesques in the Loggie of the Vatican. It is proposed to inquire how far the artists who designed and executed these arabesques have been indebted to the antique, and how far they have modified the hints derived from that source, so as to adopt their compositions to the purposes they are destined to fulfil. There will also be occasion to notice the derivation of many conventional forms, and the happy adaptation of natural objects by which these arabesques are enriched in a very extraordinary degree.

In speaking of these sort of compositions as arabesques, the term is of course adopted as it is commonly understood, and it is needless to explain that we disregard both its etymology and meaning in applying it to the paintings and stuccoes of antiquity, which represent not only foliage and fruits, but also beasts of every species, and imaginary creatures combined and interlaced together. These decorations have also acquired the name of grotesques, from the grottoes

or underground buildings in which they have been found—a term we have perverted still more from the sense in which it was invented

It is remarkable that the only mention Vitruvius makes of this style of decoration, is in reprobation of it—but he describes it so accurately, that the passage is worth repeating, if for no other reason After pointing out and classifying, what he considers legitimate objects for painting walls, such as architectural compositions, landscapes, gardens, and sea-pieces—the figures of the gods, and subjects drawn from mythology, and the poems of Homer, he proceeds thus—"I know not by what caprice it is, that the rules of the ancients, (observe, that Vitruvius looks up to the ancients in his day, that is to say to the Greeks,) who took truth for the model of their paintings, are no longer followed. Nothing is now painted upon walls but monsters, instead of true and natural objects. Instead of columns we have slender reeds, which support a complication of flimsy stems and leaves twisted into volutes. Temples are supported on candelabra, whence rises, as from a root, foliage on which figures are seated. In another place, we have demi-figures issuing from flowers, some with human faces, others with the heads of beasts, all things which are not, never have been, nor ever can be. Such is the influence of fashion, that either through indolence or caprice, it renders the world blind to the true principles of art. How can it ever be supposed that reeds can uphold a roof, or candelabra a whole building—that slender plants can support a figure, or their stems, roots, or flowers put forth living beings. Yet no one condemns these extravagancies; on the contrary, they are so much admired, that no one cares whether they be possible or not, so much do mankind render themselves incapable of judging what is really deserving of approbation. For my own part, I hold that painting is to be esteemed only so far as it represents the truth. It is not sufficient that objects be well painted; it is also necessary that the design be consonant to reason, and in no respect offensive to good sense." Pliny also laments that in his time, gaudy colouring and quaint forms were held in greater estimation than the real beauties of art. But with all deference be it spoken, there is another side to the question, which these great authorities seem to have overlooked. Conventional decorations of this kind were within the reach of thousands to whom paintings in the higher branches of art were inaccessible, and a more general diffusion of taste must have been at once the cause and effect of their universal adoption—how universal, the remains of Pompeii reveal to us. If we examine the ancient arabesques independently of these prejudices, we shall find endless beauty, variety and originality; graceful details, combined in consistent and ingenious motives and analogies, and great skill and freedom in the mode of execution. We shall also find reason to doubt whether the introduction of the arabesque style really had the effect of discouraging painting of a higher class, since even at Pompeii, poetical compositions of great merit are frequently combined with the lighter groundwork of the general decoration.

However fanciful and capricious the arabesque style may at first sight appear to be, there can be no doubt that it may be treated according to the general fixed principles of art, and that the artist will be more or less successful as he keeps these principles in view. A due balance of the composition is essential, so that the heavier parts may sustain the lighter through every gradation, and there must be such a disposition as not to cover too much or too little of the ground. Unity of design is to be studied in a connexion of the parts with each other, and in the harmony of the details and accessories, which ought as much as possible to tend to some general aim. It adds very greatly to the value of this species of decoration, when it can be made by these means, significant as well as ornamental. It would lead us much too far to enter upon the subject of colour; but it may just be observed, that in the ancient decorative painting, the balance of colour is strictly attended to. Their walls usually exhibit a gradation of dark panels in the lower part, a breadth of the most brilliant colours in the middle and principal division, and a light ground thinly spread with decoration in the upper part and in the ceiling, an arrangement dictated by the natural effects of light and shade, and reflection. As lightness and grace are the peculiar attributes of arabesque, the foliage which forms its most fertile resource should never be overloaded, its details and modes of ramification ought to be drawn from nature. The poems of Schiller and other German authors have lately been published, with a profusion of arabesque decoration in the margin, which are well worthy of attention, both for the ingenuity with which they are rendered illustrative of the text, and for the accuracy, the *botanical* accuracy, with which some of the foliage and flowers are represented, and which forms one of the greatest charms of these clever and original compositions.

Although the paintings in the Loggie of the Vatican pass under the name of Raffaelle, it is not pretended that they are the work of his hand, nor even his designs. He was indeed the originator and director of the whole, and the character and influence of his taste is visibly stamped in every part. But his coadjutors in the work were artists, whose names are inferior to none in the Roman school but his own, such as Giulio Romano, Perino del Vaga, Benvenuto Tisi, and others, who were occupied not only in the execution but in the invention of the details. Francesco Penni and Andrea da Salerno are particularly noticed as being employed for the figures, Giovanni da Udine for the fruits and flowers, and Polydore Caravaggio for the relievos. It may be worth digressing to mention, that M. Quatremere de Quincy is of opinion, that the sculptures of the Parthenon were produced by similar means, Phidias there performing exactly the same part as Raffaelle in the Vatican—and it is indisputable that the combination of unity of design with variety of detail which characterizes Gothic architecture, could have been produced only by the same system, and by employing the minds as well as the hands, of those by whom the decorations were executed. When we see perfection attained in three distinct styles of art, in three distant ages, by means precisely similar, it is not too much to assume that these means are probably the right ones.

The Loggia of Raffaelle, is an arcade in 13 compartments. The arches are open, or at least, were so originally, toward the court, of which the Loggia forms one side. The opposite side is a wall pierced with windows, one in each arch, giving light to the suite of rooms which contains the great frescos of the prince of painters. The ceiling of each compartment forms a square cove, on the sides of which are the panels containing the series of scriptural paintings, the engravings from which are known as Raffaelle's bible. These are his own designs, and some are known to have been touched with his hand. Both the lateral and cross arches are supported by pilasters about 16 feet high, panelled, and decorated with coloured arabesque on a white ground. Each pilaster on the wall side is flanked by a half pilaster, in which the arabesque is carried through on a smaller scale of composition. It is to these pilasters the present remarks will be confined. We shall find in them as much matter as with the collateral observations to which they will give rise, will fully occupy the time at our disposal this evening.

The description of the pilasters will be taken in the order in which Volpato has engraved them; that is to say, beginning on the side next the wall.[1]

No. 1. Notwithstanding the great variety in the composition and details of these works, we shall find a general unity of design prevailing throughout, with the exception of the last five of the series, which will be particularly noticed in their turn. Whatever form the composition may take, it is rendered subservient to the introduction of four medallions, or tablets, relieved from the back ground in stucco, of contrasted shapes—one like an antique shield—the next circular—the third rectangular, and the fourth in the form known as the *vesica piscis*. These medallions occupy the upper part of the pilaster, to the extent of about one third of the whole panel, while the lower part, to the height of the dado, or somewhat higher, is generally filled in such a manner as to afford a *weight of colour*, sufficient to support itself by the side of that member of the architecture, and the members introduced into its panels, following in this respect the practice of the ancients. These medallions might appear to vio-

[1] We must refer the reader to Volpato's engravings, which were exhibited when this paper was read. They are easy of access.

late the due balance of the arabesques, if they were identified with them; but the composition is rescued from that fault, by the separate character given to the decoration of the medallions, and by their being detached, and hung as it were, independently upon the back-ground. In the general arrangement of the whole, these medallions perform a very important part, connecting the pilasters with the panelled stuccos adjoining, both by their relief, and by means of an accordant style of decoration and a similarity in the subjects represented upon them, neither of which could have been well embodied in the arabesque itself. (see Plate I, Fig. 1.)

It must be admitted, that these compositions considered separately, are somewhat unequal, and the examples to be first passed in review are by no means the best; but instruction may be derived from a consideration of their defects. There are in this pilaster, (No. 1,) many graceful details, but the effect is less pleasing and satisfactory than in some others where there is a greater unity of composition, and where the objects are less varied and numerous; moreover, too many of the forms in this example are somewhat stiff. The guillochi which occupies the lower part of the half pilaster, is extremely rich; and we shall find throughout the series, that this part of the composition bears a solid and architectural character, in conformity with the principle which has already been adverted to. Upon the stuccos it is not my intention to dilate; I would merely draw your attention to the beautiful simplicity of the panelling. The antique figures which fill the compartments would require a separate dissertation to describe them only. They harmonize, as before observed, with the subjects contained in the medallions. The clusters of natural fruit and foliage which surround the windows are continued throughout the series of arches, and are greatly varied in detail, though precisely similar in composition. There is nothing conventional in these festoons—the clusters are simply connected together by a string, and are composed of the most familiar objects rendered with perfect truth. (Fig. 3.) The melon, the orange, the chesnut, the tomata, the olive, grapes of different kinds, pomegranates, gourds of every description, pine and cypress cones, are those which most frequently recur, with their foliage and blossoms. The artist has not even disdained the cabbage, the cucumber, and the onion.

Fig. 3.



No. 2, has the same faults as the first. The frame, with the horse, saddled and bridled, is quite in the spirit of the antique decorations, but it divides the pilaster disagreeably, and is not a proper subject to occupy the principal place in the composition. In the side pilaster we have a rather thin and wiry scroll, of which both the foliage and flowers are conventional, but the convolvulus major twines beautifully and naturally over the fret below.

In No. 3, a closely woven festoon of foliage and flowers is formed into panels—not, I think, very happily, since the arrangement is such as the eye does not very readily comprehend, and even if it were more simple, it would scarcely be applicable, since it divides into many distinct parts the panel which is in itself a single feature of the general design; its integrity is therefore destroyed by this mode of decoration. The subjects which occupy the panels are, however, well worthy of attention. The group of deer, the landscape, the dog chasing a porcupine, the Cupid on the dolphin, and the two winged children manœuvring a dancing bear, are all in the true spirit of the antique. The single figures are less so; an ancient painter would not have placed them on a scrap of earth. In the Pompeian decorations, the detached figures—I do not speak of such as are inclosed in frames, but the *detached* figures—partake of the artificial character of the style to which they are adopted, and if they are not represented as floating in the air, they stand upon a bracket, or a mere line, or on anything but the natural ground. In the panels of the stucco are male and female chimeras, enveloped in a scroll formed of the natural branches of the briar rose.

In No. 4, we arrive at a greater unity in the design, for though it consists of many parts, yet they all bear upon each other, and are mutually connected throughout. The temple which forms the centre of the composition is altogether in the style of architecture which holds so important a place in the arabesques of the baths of Titus and Pompeii. I call it *a style of architecture*, for in the ancient paintings, where it generally forms the framework of the composition, and contributes greatly to that unity of design which distinguishes the ancient arabesque, it assumes a regularity and consistency which fairly entitle it to the appellation of *a style.* The supporting figures are objectionable, for they are in motion—common walking motion. Much more objectionable are the terminal figures which rise from the acroteria of the temple.

My objection to these terminal figures is, that they are improbable. Improbable, I mean, upon certain postulates, which it is necessary to assume before we can reason upon these imaginary compositions at all. The mythology of the ancients has peopled the elements with beings compounded of the human and brute creation, their intelligence being indicated by the first, and their fitness for the region they are supposed to inhabit by the second. There is nothing in ancient art, in which greater taste or judgment is displayed, than in some of these combinations. The animal functions appear in no wise compromised by the mere interchange of corporeal members, between different species. Such combinations, therefore, as long as they involve no glaring disproportions, present nothing repugnant to the mind; and we are so familiarized to them, that we pronounce upon the success of the representation of a triton, a satyr, or a centaur, with as little hesitation as we might upon that of any of the animals of which they are compounded. We are equally ready, or perhaps owing to a stronger association of ideas, *more* ready, to admit of aerial beings, supporting themselves on wings, floating in the ether, or alighting upon a flower without bending the stalk, though these

are, in fact, less probable than those born of the ocean or the earth. Between animal and vegetable life there is also a sufficient analogy to attach some probability, or at least to afford an apology, for the graceful combinations between these two kingdoms of nature, invented by the ancients, and adopted to a very great extent in the compositions before us; but, when we come to combine animal life with unorganized matter, the probability ceases; and if, as in the case before us, the unorganized portion is something artificial, and totally out of proportion besides, the combination becomes intolerable. Thus we acquiesce in the metamorphoses of Ovid or the Arabian Nights, as long as certain analogies are observed; but the transformation of the ships of Eneas into sea nymphs, is, as one of our greatest critics has observed, a violation of probability to which nothing can reconcile us.

No conventional form has been more abused than the terminus. Intelligence and immobility are the attributes which the ancients intended it to embody, but their apposite creation is totally different from anomalous compositions like this, into which it has been tortured.

The scroll in the half pilaster of this example is greatly superior to that in No. 2. It is more simple in its composition, and the leaves are broad and natural, and fill the space much more satisfactorily than a multiplicity of wiry lines and flimsy objects, producing confusion, and destructive of breadth of effect.

In No. 5, we arrive at a superior composition; for it must be repeated, we are examining the decoration of a single member of an extensive *whole*, and that however beautiful each may be, unity is a beauty in addition. No object in decoration has been so extensively used as the scroll. The ancients do not appear to have been afflicted with an unhappy craving for novelties, nor to have been haunted with the apprehension that beautiful forms of composition would become less beautiful by repetition. When the most appropriate forms in architecture and decoration were once ascertained, they were continually repeated, but marked with a fresh character, and stamped with originality by those refined and delicate touches which were all-sufficient when they were properly appreciated. We need only refer to the temples of the ancients, to see how pertinaciously they adhered to an established principle, and to the varieties in the proportions of the Doric order, or the character of the Corinthian capital, varieties which we may be assured were neither capricious nor accidental, to see how studiously they availed themselves of all the resources of art in its details. In the same manner with regard to the ever-recurring form of the scroll, as long as the foliage and ramifications of nature are unexhausted, so long will it be capable of assuming an original character in the hands of the skilful artist. A striking illustration of this position may be drawn from the arabesques in the palace of Caprarola, where the pilasters of the Loggie are decorated with scrolls, all similar in composition, but each formed of a different species of natural foliage, without the intermixture of anything conventional, except the regularity of the convolutions. I regret that I can show but three of these beautiful scrolls, and those very slightly represented. They are composed of the olive, (Fig. 4,) the vine, (Fig. 5,) and the convolvulus, (Fig. 6.) The latter being rather thin in proportion to the others, is enriched with birds.

Fig. 4.



Fig 5.



Fig 6.



For the magnificent scroll before us we are indebted to the antique. It is an imitation of the well known marble in the Villa Medici, but the artist has made it his own by the skill with which he has adapted it to his purpose both in proportion and colour (see Plate I, Fig. 2.) I would particularly call your attention to the animals, the squirrels, the mice, the lizards, the snake, the grasshopper, and the snail, dispersed about the branches, so well calculated to fill the spaces they occupy, and at the same time producing a variety which would have been wanting, had the foliage only been extended with that object. To the scroll in the half pilaster, it is to be objected, that it is a repetition in small, of that in the principal compartment; but if examined separately, it will be found full of instruction, from the union it displays of natural objects with conventional forms. The spiral line of the antique scroll, is evidently drawn from the natural course of climbing plants. It is conventional in its openness and regularity. The involucra of plants furnish the hint for the base from which the antique scroll is made to spring, and the spathes of the liliaceous tribe for the sheaths, of a conventional repetition of which, the ancient sculptured scrolls principally consist. Thus far for the general elements of the antique scroll, which the artist has implicitly followed in the example before us; but he has enriched his composition without disturbing its unity, by making every sheath produce a different branch, drawn immediately from nature. The birds present an equal variety, and are occupied according to their natural habits, in feeding on the berries and buds, or on the variety of insects which are also introduced. The arabesques in the side panels are to be particularly noticed in this example. A *motivo*, however slight, is always to be desired, and here we see a very graceful one, in the two winged boys, who dip into a vase-like fountain. The winged bear,

which occupies the medallion, may be noticed, as a violation of probability. A being to cleave the air, should not be selected from the most heavy and awkward of animals. It is undoubtedly intended for a *jeu d'esprit*, and is quite in the spirit of the antique. The ancient frescos are full of such whimsical combinations, but always, as in the present instance, occupying a subordinate place.

No. 6 is worthy of an attentive examination; the lower part is extremely fanciful, and well adapted to its purpose. For his principal object the artist has chosen the Diana of Ephesus, with her attributes, forming, with some arbitrary decorations, a remarkably well balanced composition, of which the rectilinear shapes contrast in the happiest manner with the flowing lines above. The Diana constitutes a foreground, behind which rises a slender tree. There is nothing more graceful throughout the whole series than the branches of this tree, and the winged boys who sport among them and enjoy the fruit. (Fig. 7.) Equally graceful are those who gather barley from the Cornucopia, and grapes from the loaded trellis above.

Fig. 7.



No. 7 is one of the most remarkable of the series. In this the artist has ventured, and with the most perfect success, to discard every thing conventional, and to represent a natural tree, balancing its irregularities of ramification and foliage by the numerous birds which occupy the branches, where they may be supposed to have been collected by the call of the bird-catcher, who is concealed in the underwood with his bird-call in his mouth. (See Plate I, Fig. 1.) One bird, fettered by a limed twig, is about to fall into his hands. It is impossible to admire too much the skill with which this simple *motivo* is worked out. The arabesque of the side pilaster is one of the best of this order; all the parts are graceful in themselves, and well balanced, both in form and colour. This composition is also to be remarked for the introduction of some of the heraldic insignia of the holy see. The keys in saltire, the umbrella, the papal tiara, and the fisherman's ring, with which the successors of St. Peter are invested. I am rather surprised that this sort of allusion has not been more liberally used.

No. 8 is perhaps the least pleasing of the series. There is a total want of unity in the composition, which is merely a repetition of similar designs, and these not a little stiff and formal. There is likewise too great a weight, both of form and colour, toward the top; but the scroll in the half pilaster is beautiful, and closely resembles that in No. 4.

It will be unnecessary to dwell upon No. 9, since it is precisely the same in general character as No. 5, though varied in its details, in the disposition of the animals, and the mode of spreading the lighter ramifications at the top.

No. 10 bears nearly the same relation to No. 4, upon which we have already remarked at some length. It may be further observed in reference to Nos. 4 and 10, that folds of drapery are too broad and heavy to be successful in arabesque, its effect is seldom pleasing. I must also protest against the birds which crown this composition. Nature has provided a variety which makes it quite unnecessary to seek novelty by combining the neck of one species and the tail of another with imaginary wings. The first impression is that these birds are meant for swans; the second, and abiding one, that the artist did not know how to draw a swan—he has not mended them by dressing them in trousers. The scroll in the half pilaster is composed in the same manner as in No. 5, but is better filled.

The next example may be considered a *pendant* to No. 7, which, however, it by no means equals. The stem is a natural reed, each joint conventionally expanded into a calix, from every one of which sprouts a branch of a different species; here are the wild celery, the rose, the blackberry, the arundo, the privet, the grape, the olive, and the barley. The panthers in the stucco panels are appropriately combined with the ivy and grape.

Of the more varied and fanciful compositions on this side of the Loggia, No. 12 is one of the best. It wants unity, and the introduction of so dull a reality as a curtain in the midst of so many objects of pure fancy is displeasing; neither can I reconcile myself to the termini in the upper part. Independently of other objections, they are too essentially terrestrial to enter into combination with these light sprays—an aerial terminus is a contradiction. They are, however, well treated when compared with those in No. 4. The separate parts of this composition are greatly to be admired, especially the *motivo* of the lower part, and the unity which pervades the fanciful combination above it.

No. 13 is in the same style, but much superior. Taking the lower half as complete in itself, nothing can be more gracefully designed, or more perfectly balanced, which latter is, perhaps, after all, the most important point in the composition of arabesques; they will certainly be found more or less pleasing on a first impression, as this condition is more or less perfectly fulfilled. The solidity of the base, the breadth of the parts forming the next step, the lightness of the Pompeian architecture above, and the fluttering character of the objects which surmount it, constitute a gradation which satisfies the eye, while the variety of detail fills the imagination. The upper parts of both these examples abound too much in trivial and wiry details, such as ribbons and strings of jewellery, which are introduced to convey the idea of excessive lightness, but have rather a contrary effect, by producing confusion, and are also too artificial to harmonize with the general character of the composition.

The last on this side repeats No. 3 in the principal composition, and No. 10 in the half pilaster, and therefore requires no observation.

The twelve compositions which occupy the piers on the open side of the Loggia, differ remarkably from the 14 which have been described, and a perfect unity of design distinguishes the majority. This was, perhaps, the more easily accomplished, since (the architecture necessarily differing from that on the side next the wall) the dado is continued across the pilaster, and forms a separate series of panels, each of which is filled with a natural or imaginary being, adapted to the element of water. The half pilasters are also omitted on this side, and a greater breadth of design given to the stuccoes which are brought into immediate contact with the larger arabesque.

In No. 15, the artist has chosen the apparently incongruous subject of fish to combine with his foliage. In a painting by Hogarth we see in the fashionable furniture of one of his scenes, a composition of foliage inhabited by fish instead of birds, and though this absurdity be ntended as a caricature of the taste of his day, it is no great exaggeration of the fact. In this design, the foliage and the fish are brought ogether without the slightest violation of probability; the fish have been hung to the branches; the variety of their forms and colours produce an admirable effect, and above all, they are perfect in the condition, more especially indispensable in objects not intrinsically graceful or pleasing, of being represented with the most absolute truth to nature. We have the haddock, the lobster, the dory, the cuttle-fish, the whelk, the perch, the shrimp, the crab, the gorbill, the muscle, the cockle, the mullet, and the anchovy. This example may teach us that objects for decoration may be sought throughout the whole range of Nature's works with hopes of success.

A more graceful conception than the double scroll which forms the subject of No. 16 it is difficult to imagine. It combines unity of design with an unexceptionable balance of parts, and the most perfect lightness devoid of any thing trivial. This composition might be considered absolutely faultless, were not the two figures placed within the scroll rather too small to bear a proportion to some analogous forms, combined with other parts.

Of No. 17 it can hardly be said the effect is pleasing; but both the *motivo* and the grouping of the musical instruments are greatly to be admired, as well as the skill with which the ends of the ribbon are made to fill up and balance the composition, which is well worthy of study, as showing how advantageously familiar artificial objects may

be employed in decoration, when used in their proper place, and not discordantly associated.

Unity is again lost sight of in the design No. 18, but the different objects which compose it, are harmonized upon a totally different principle from any which have been hitherto examined, and the effect is rather dependent upon colour than on form. The panels contrast brilliantly with the white background, and are relieved and rescued from heaviness by the sharp dark lines which surround them; this is quite antique. The component parts of the upper portion of this pilaster must not be passed over unnoticed:—the Cupid and Psyche, the lions with their cubs, the Satyrs grouped with the lower medallion, and the scroll work, which is entirely free from the trivial and confused appendages of which there is reason to complain in some of the former examples.

The general design of No. 19 is the same as in the last example, but its development is scarcely equal, except in the subjects which fill the panels, which are in the highest degree classical and elegant. I ought, perhaps, to have noticed the Tritons, male and female, which occupy the dado of the three last pilasters, but I cannot pass over the bird introduced into this; we are not only presented with the form of the creature, but the skeleton of the fish in its claw indicates its habits also, with the most scrupulous attention to nature; equally true are the bull-rushes in the back grounds.

No. 20 appears to me inferior to any other on this side. The lower part is good, but misapplied, every portion being too minute for its place in the general design. The observation on the drapery need not be repeated. The upper part, besides containing too many trivial and wiry forms, exhibits two or three objectionable matters of detail which it will be proper to point out. The swaddled children are equally unpleasing to the eye and the imagination, and are therefore improper objects for decoration; the heads are also objectionable. To masks there can be no objection—we are familiar with them as a decoration of the ancient theatre; the association does not desert us, though neither the mask nor the manner of its application may have any thing in common with its origin, and though it may be coloured to the life, it is but a mask. But if a bust be introduced, unless it be represented as a sculptured bust, it suggests the idea of mutilation, or what is still more degrading to its character, a coloured wig-block. And even if the heads could be tolerated, nothing can be more ungraceful than holding the festoon in the mouth. Again, in reference to these cornucopiæ (to say nothing of their being ill proportioned and badly drawn), the blossoms and foliage which issue from them are attached at the other end to the scroll above, so that we are in doubt to which member of the composition it belongs, or rather, we see that it confusedly belongs to both. On the sort of termini which finish this arabesque, enough has already been said.

Fig. 8.



The remainder of these compositions are of a different character from any that have preceded them, their basis being more architectural, and suited to be the framework of a series of figures which, in the five last examples, reach to a much higher order of art than mere decoration. The lower part of the design No. 21, is in itself beautiful, independently of the figures combined with it, which in composition and drawing, are truly worthy of the Roman school. They do not appear to form any connected subject, like the rest which follow, but the *by-play*, if it may be called so, by which they are united, greatly adds to their value. The attitude of these lower figures, so perfectly adapted to the place they occupy, has its motive in their retreat from the monkies by whom they are threatened, and the monkies are held carelessly by the figures above who are occupied in imitating with looking glasses the dragons, whose undulating forms so gracefully supply the lighter materials of the composition. The medallions which have hitherto accompanied us, are laid aside in this and the remaining pilasters. (Fig. 8.)

Fig. 9.



No. 22 is the first of these connected designs to which I have adverted. In these groups we have the four seasons embodied in personifications truly Raffaelesque:—Spring distinguished as the pairing season—Summer by a group loaded with ripe grain, and the fruits of the season spread at their feet—Autumn by the vintage, represented with a grace and fancy which it is difficult to find words to characterize adequately, (Fig. 9,) and Winter by a composition well calculated as a base for the pyramid which rises from it. To point out the beauties of this painting as regards decoration, is to take a very narrow view of its merits; every one of the 14 figures it contains might be studied as an example of all that is great and graceful in the Roman school of art.

No. 23 also is not more remarkable for the skill with which the parts are combined, than for their separate excellence. The niches and superstructure, supported by caryatic figures, serve as a basis for the three fates drawing the thread of human life. Observe well the pertinency of all the attributes:—the respective ages of the three females, the opening blossoms which surround the first, the ripened fruit which accompanies the second, and the monumental character of the niche in which the third is placed, with the human emblem of mortality at her feet; and to descend to the lower compartment, we have again to admire the perfect attention to nature in the bird, and the berry-bearing plant in which it is feasting.

The next compartment (No. 24), is also full of a moral intention. The principal figures are emblematical of the flight of time. The horary dial supports an admirable group of day and night, with their emblems, dominated by the personifications of the sun and moon; they are accompanied by the well known emblems of time and eternity, and we may find much meaning, even in the steel yard, classically weighted with heads of Janus regarding the past and the future. None of the series is more elegantly terminated than this, though the group does not appear to have any immediate relation to the main subject.

Nothing can be in a higher style of art, than the personifications of Faith, Hope, and Charity in No. 25. To enlarge upon their individual excellence would be foreign to the present purpose. I must only draw your attention to the manner in which they are made subservient to the general design of filling the space they are intended to decorate, and the spire-like form in which they are made to rise from the heavy to the light.

The last compartment is dedicated to the sciences of geography and astronomy. The terrestrial and celestial globes, borne by the genius below, each support figures emblematical of that part of the universe which they represent. On the one lies the earth-born Antæus at the feet of Hercules, who is represented in his appropriate labour of supporting the heavens, while a winged being of celestial aspect crowns the other.

Having now completed the review of this series of arabesques, it is not my intention to detain you by any lengthened observations upon them, such as occurred having been expressed on the immediate occasions on which they arose. I began by stating the principles which I conceived might be illustrated by this review and in con-

clusion, I venture to suggest the examination and study of arabesque composition as practised by the ancients and the moderns—a comparison of the Baths of Titus, and the remains of Pompeii and Herculaneum, with the Loggia of Raffaelle, the Villa Madama and the Palazzo T, as one of the most instructive lessons that can be devised upon the varied and original results that may be derived from the same materials, according to the different lights in which they are viewed, the different modes in which they are studied, and the different purposes to which they are applied. In the resources which the decorative artist can call to his aid, the moderns have greatly the advantage over the ancients, since we possess their materials and our own also. For as long as ancient authors are read, and ancient art appreciated, so long will allusion to the manners, customs, poetry, and religion of antiquity be familiar to us, and the symbols to which they gave rise be universally understood; indeed numberless allusions of this kind are constantly before us, and are so familiar that we forget to inquire their origin. In personification, and the embodying of abstract ideas, the field is as open to us as to them, and we see to what advantage it may be turned by the examples we have just passed in review; and if we add to all these objects those derived from the useful arts and sciences which may be turned to account in the hands of the skilful decorator, his resources may be considered boundless. For as we have seen in these examples, it is not the familiar aspect of any object which should banish its representation from works of fancy. Every thing depends upon its proper application. The ancients made the best use of whatever they considered most appropriate, and we must endeavour to do the same. Thus, on the pedestal of the Column in the Place Vendôme, a professed imitation of that of Trajan, modern arms and habiliments occupy the place of those of the Roman period sculptured on the original. Whether this translation be as well executed as it might be, is not now the question. It is noticed merely as being right in principle. One fertile source we have, totally unknown to the ancients, from which materials may be drawn for decoration, carrying with them the invaluable quality of being in all cases significant as well as ornamental—I mean the science of heraldry. I cannot help thinking that the Greeks, who used so much diversity of colour in their architecture, would have availed themselves liberally of the tints of heraldry in their decorations, had they been acquainted with it. From the personal allusions it conveys, it might be made a much more important feature than it even now is, in the decoration of private as well as public buildings, and we have only to study the works of the middle ages for invaluable hints on the mode in which it may be applied. The mere display of shields of arms is but one mode. We shall find heraldry intimately woven into the ornaments of our Gothic buildings, and he who can read its language, may often understand an allusion in what may appear, at first sight, a mere decoration. Thus, one of the mouldings of the tomb of Humphrey, Duke of Glocester, at St. Albans, is filled with an ornament, which, on examination, resolves itself into a cup containing flowers, a device assumed by that Prince, says a MS. in the college of Amis, "as a mark of his love for learning." Heraldry has not been neglected in modern Italian art, and a very well imagined arabesque may be seen at the town hall at Foligno, where the ceiling is covered with foliage spreading from the centre, on the ramifications of which are hung the shields of the nobility of Foligno for many generations. And at Macerata there is a church decorated in a very peculiar style, bearing throughout an allusion to the name of the founder.

A. P.

Pompeii.—The *Frankfort Journal* of the 10th November, states, that the last excavations made in the Street of Pompeii brought to light a number of paintings in fresco, which were affixed as an ornament to four adjoining houses. One of those paintings was remarkable for the extreme correctness of the design, and for the freshness of the colouring. The subject of this painting is Bacchus and a faun pressing grapes, which are borne by a young slave, whilst a child is pouring the wine into a vessel fixed in the earth.

BUILDINGS IN BELGIUM.

By George Godwin, Jun., F.R.S., &c.

"Perhaps no study reveals to us more forcibly the social condition and true feeling of passed generations than that of their monuments."—M. Guizot.

Chapter I.

Belgium contains a multitude of interesting examples of architectural skill in the middle ages, eminently worthy of careful study, and sufficient, from the diversity of the epochs they mark and the character they bear, to illustrate fully a history of the rise and progress of Gothic architecture, and the re-birth of Italian art. An essay on the architecture of Belgium, its peculiarities, its gradual alteration, and its connexion with the architecture of other countries, would be a valuable work, and, so far as I know, is yet to be done, notwithstanding that most of her chief buildings are almost universally known. The present memoranda consist simply of the jottings made during a brief visit to the country in question, and are published with the feeling which has in other cases led the writer to take the same course, namely, that if every one will bring a stone, you may soon raise a pyramid.

The domestic architecture of Belgium offers an infinite variety, and affords numerous hints for present application. Within a very small circle, in some cases even in a single city, examples may be found of the different styles of building which have prevailed at intervals, say of fifty years, from the 11th or 12th century up to the present time. Such towns are a book which those who run may read, and afford a great amount of pleasure and information to those who will pause to think. At Tournay, a most interesting old town, close to the French frontier, towards the western extremity of Belgium, (and of which I shall hereafter speak again,) there are several exceedingly ancient houses; one of an interesting character is situated near the church of St. Brixe. The whole is of stone, and terminates in a gable. The windows, about 5 feet high and 4 feet wide, are each divided into two openings by a small column with plain leafed capital. One of the lower windows has simply a rectangular mullion down the centre, the edges of which are chamfered to within a certain distance from the top and bottom. The string courses, consisting simply of a square member and a hollow, continue through the whole front, and form straight window heads, over which are introduced discharging arches. The adjoining front is precisely similar. In the Rue des Jesuits there are some houses of the same character, but of a somewhat more advanced period. The columns and caps are nearly the same as those before mentioned, and the upper part, perhaps 50 or 60 feet in extent, consists wholly of windows and small piers alternately.

Ghent and Malines display similarly ancient houses.

An early advance upon this arrangement would probably be the introduction of a transom to divide the windows into four, and so to form a *croisée*. In the gable of an old house at Ghent, near the Hotel de Ville, appears a large pointed window, quite ecclesiastical in aspect, with mullions, traceried head, and label. A house near the Grand Place at Tournay affords a very perfect example of the appliation of pointed architecture to a street front, at the beginning of the 16th century, and the Hotel d'Egmont at Ghent, shows another application of the same style at a period when it was beginning to exhibit symptoms of decline; as also on a much more elaborate scale, does the well known *Maison des Franc Batchers* in the same city.[1]

Near the Eglise de Château at Tournay is a large building, now the Horse Infirmary for the artillery, which would seem to be an example at a later stage of the decline. It is constructed of red brick and stone, and presents gables, pointed headed windows, other square windows divided by mullions, and large dormers in the roof. The mouldings, however, are Italianized, the discharging arches, partly stone and partly brick, which occur even over the pointed headed openings, are made into adornments, and all the ornaments which appear are of mixed design. Later still, the line of the gable became altered into

[1] Mr. Donaldson has made a very interesting series of sketches to illustrate the gradual progression here only hinted at.

a scroll, the mullions of the windows disappeared, and the Gothic panelling on the face of the building gave place to pilasters and entablatures elaborately adorned with figures, fruit, and foliage, as may be seen in numberless examples remaining in most of the towns.[2] The Town Halls and Belfries form a striking feature in Belgium, and in some cases are singularly beautiful. Amongst the privileges granted to the towns when they first acquired communal rights, none seem to have been deemed greater, or were more speedily acted upon, than the right of building a belfry to call together the citizens, and a hall as a general meeting place.

The Hall at Louvain, which has afforded a subject to so many of our artists, is now unquestionably one of the most perfect specimens of a civic building raised by the medieval architects, which remains to us. The whole of it, a pile of crocketted canopies, corbels sculptured into numberless figures, windows, panelling, and elegant turrets, has been restored in a very able manner.

The Town Halls of Bruges, Audenaerde, Ghent, and Brussels, are other examples of great interest. The spire of the latter, which is remarkable for its lightness and elegance, is now being restored, and I cannot avoid making this an opportunity to remark, that the desire to restore the buildings left us by our fathers, which is, at this time, developing itself simultaneously in England, France, Germany and Belgium, is no unimportant sign, and will serve hereafter to characterize the 19th century. Valuable as the result is, the feelings which prompt to it, and of which it is but the evidence, are more important still.

The west front of St. Gudule at Brussels, the cathedral at Antwerp, and St. Bavon at Ghent, are amongst the principal buildings in Belgium, which have been lately repaired. More important perhaps than any, however, are the restorations now going on at the cathedral of Tournay, which is one of the most interesting structures in the country, whether regarded *per se* as a specimen of the architectural skill of two different periods of time, or as recalling by association the events of many ages.

Seen from a distance, with its forest of towers high above the surrounding buildings, its effect is very striking; nor are the pleasant anticipations so raised in any degree lessened by a close approach. In form, it is a Latin cross, with five towers; namely, one on the east, and one on the west side, at each end of the transept, and one at the centre of the cross. The transept is terminated at each end by a semi-circular absis, similar to many churches in Cologne and other parts of Germany. The nave has an aile on each side, separated by piers and small columns bearing semi-circular arches, which in various parts approach the horse-shoe form.[3] Above these, is a second range of piers and arches, of similar or greater height than the first, forming the front of a large gallery, extending the width of the ailes.[4] Over these, is a series of arches against the wall, springing from short piers. The clerestory and the vaulted ceiling were the work of barbarous repairers, in 1777, and took the place of the ancient wooden roof: they will shortly be restored to their original appearance.[5]

All the capitals of the lower columns in the nave are sculptured to represent foliage, and are exceedingly sharp and clear. In earlier times, they were all painted and gilt, and further decorated by scripture mottoes around the abacus. Much of the stone-work is rough and has been covered with stucco: the columns and other parts that were exposed, are of Tournay stone polished.

[2] Lille, a French town, but close to the Belgic frontier, displays a great number of houses of this character, of great richness, and in some cases, much beauty.

[3] The piers occupy a square of six feet on the plan, set diagonally. The openings are 13 feet 6 inches wide, and about 11 feet 6 inches high to the springing of the arch. There are nine such compartments on each side of the nave.

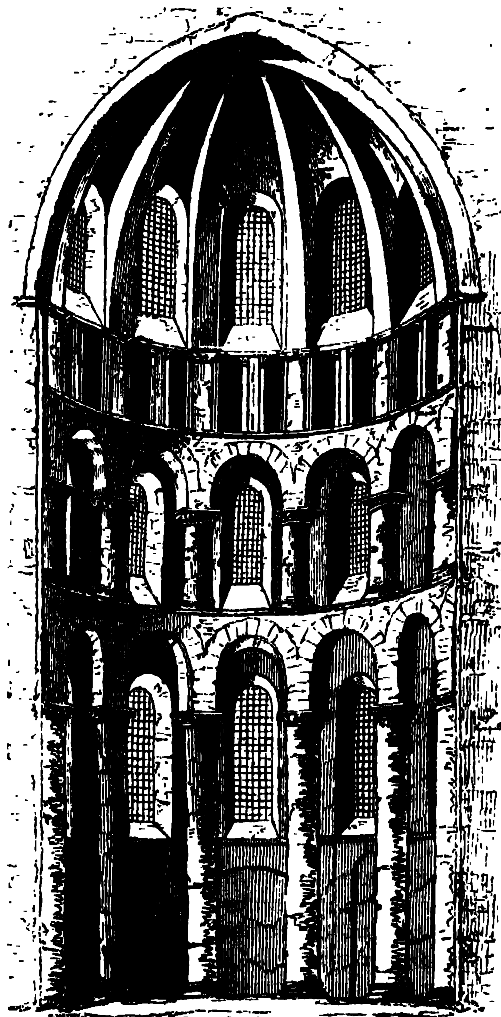
[4] The galleries in ancient churches were used for the purpose of separating the sexes, and even different ages of the same sex. This was perhaps rendered necessary by the custom of *saluting*, which then obtained amongst the "faithful."

[5] During the whole of the 18th century continued injury was done to the building, by injudicious endeavours to support the fabric; many openings, especially in the transept and the clerestory of the choir were bricked up; the capitals of the columns and other decorative portions were covered with whitewash, and the frescoes which adorned the walls destroyed.

The four great arches at the junction of the cross are pointed, and have also been embellished by colour, much of which is still visible.

The interior of the semi-circular absis, terminating the transept at either end, is exceedingly beautiful, and produces a very striking effect. The annexed sketch, (Fig. 1,) may serve to give some general idea of its arrangement. At the bottom, a series of six lofty columns two feet eight inches diameter, and about 24 feet high, built up of ten courses of stone, and placed at a short distance from the wall of the absis, support narrow semi-circular arches raised on legs. Over these are two triforia and a clerestory, and the whole terminates in a half dome with plain ribs converging to a point.[6] The capitals of the columns consist of volutes and of leaves. The base of each pillar has four sculptured leaves at the angles of the pedestal.

Fig. 1.



Originally the choir was about one-third the length of the building, and terminated in an absis similar to those of the transept in form and style. This portion of the building, however, was rebuilt, as is mentioned hereafter, and is now an exceedingly fine specimen of the pointed style, resembling in some respects the choir of Cologne cathedral, although executed much before that wonderful building.

The present choir has an aile and a series of small chapels on both sides, which continue round the east end. Lofty columns bearing acutely pointed arches, separate the ailes from the choir. In each spandril of these arches is a circular ornament in mosaic work, and

[6] These vaults are formed of rubble work, under a wooden roof, and are less than two feet in thickness.

above rise a very elegant triforium and lofty clerestory. Behind the triforium is a series of peculiar quatrefoil lights, blocked up and unknown until lately (as indeed was the whole of the triforium), but now again filled with stained glass.

The choir is elevated above the nave by three steps, for about one-third its extent, and then by a fourth the remainder of the length, and is paved with black and white marble in squares. The high altar has four additional steps. The pillars in the choir were originally constructed with that daring which characterizes many of the earlier efforts of pointed architecture, and soon gave symptoms of insufficiency. They were then strengthened by additional masonry at the back, and even now are remarkable for their lightness and elegance. It may be mentioned, that when the choir was rebuilt, the old chancel arch which was probably semi-circular, was cut away to make room for a pointed arch; as also was the case at the entrance from the transept to the aisle of the choir on each side. Painting and gilding have been used throughout as a means of decoration, and will probably be again resorted to when the whole of the substantial repairs have been executed.[7] A series of flying buttresses (seen in the sketch, at the head of the second chapter), surround the choir externally, and it is between these that the chapels are formed, terminating in gables.[8] The roof of the choir above the vaulting is of oak, and of great height.

Round the outside of the clerestory of the nave there is a continuous gallery, formed within the thickness of the walls, and faced by small octagon columns and arches of the Tournay stone, originally polished.[9] Elsewhere there are various galleries in the walls, so that all parts of the building are practicable.

The same stone is employed in the construction of the building as the rock consists of on which it stands, so that it may be said to be a continuation of the solid substratum. Nevertheless, there are many very serious fissures and settlements, especially in the transept and choir, which need extensive repair. The west front of the building has been disfigured by various alterations; a groined porch in the pointed style extends the whole length of the front, and above it a large pointed window has been introduced, so as to destroy entirely its original character.[10] There is a variety of sculpture under the porch, but the greater part of it is modern and very uninteresting. The cathedral is entered by two doors, one on the north side of the nave, and the other on the south, adjoining the transept. The north door is seen in the external view of the north absis at the head of the next chapter, (Fig. 2,) and is of the transition period. It consists of a semi-circular archway beneath a pointed trefoil arch, the whole profusely adorned with ranges of sculptured figures, animals, and foliage. On each side of the light which occurs between the circular and the pointed arch, is a small twisted column. The four towers of the transept are each different in detail, and have been executed at different times. They all display, however, a mixture of pointed and semi-circular arches.

The whole length of the cathedral within the walls is, as nearly as I can estimate it, 420 feet. The transept, which is nearly in the centre of the building, is 212 feet from north to south. The width of the nave including the ailes, is 70 feet; the choir is a few feet wider. The height of the choir is 110 feet. As a datum for comparison, it may be mentioned, that Salisbury Cathedral, according to Mr. Britton, is 450 feet long within the walls, 78 feet wide in the nave, and that the height of the choir is 81 feet; in other words, it is 30 feet longer, 8 feet wider, and 29 feet lower than that of Tournay.

[7] In a chapel, south side of choir, the spandrils of an arcade are painted to represent angels bearing scrolls.

[8] These flying buttresses are double. The upper arch was apparently formed first, and this being found insufficient the lower arch was then added.

[9] There is a curious gallery of this description round the Eglise de Chateau in Tournay.

[10] The west front had originally two small towers at the angles. These towers at the extremity of the west front, are found in many buildings in Belgium, at the Eglise de Chateau before mentioned, St. Bavon, Ghent, &c.

(To be continued.)

CANDIDUS'S NOTE-BOOK.
FASCICULUS XLIV.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. Were architectural performance to keep pace with architectural promise in this country, we should have some magnificent works; but as ill-luck will have it, either something or other interferes to check the undertaking—to blight it in the bud, or the thing itself turns out wofully inferior to promise—far more liberal than discreet. Of such untoward *turn-outs*, not a few might be enumerated. The poor Edinburgh Parthenon was nipped in the bud: after a few of its columns were put up, it was discovered that "Auld Reekie" was not another Athens, and that an Hellenic Doric face would look as awkwardly upon the Calton Hill, as the helmet of Minerva herself upon an old washerwoman or Meg Dods. It was to have been a temple of Scottish worthies, but some one asked where they were to find worthies to fill it; so though that Parthenon did not fall to the ground—for there was nothing but a few columns to fall, and they are still standing—the scheme did. Not so that of Buckingham Palace; that was erected, and remains a monument of those twins in architectural taste, King George (IV.) and Mister Nash. We were there promised "a magnificent edifice in the most dignified style of Grecian architecture." So magnificent was the original design—so carefully had every part been studied beforehand, that no sooner were the two little boxes intended for wings put up, than it was found out that they were intolerably paltry, and must come down again; and afterwards, another grand discovery was made, namely, that the little dome on the centre of the west-front, was so impertinent as to show itself from the Park, where it was not intended to be seen—and that it would so, might have been ascertained, by a model of the intended structure; but models are expensive things—too expensive to be thought of by such a strict economist, and so careful of John Bull's pocket, as was John Nash! The National Gallery, at any rate its façade, was to have been a prodigiously classical piece of architecture; whereas, its *turn-out* exhibits to us a "beggarly account of empty" niches above, and a cockney display of area railings, and kitchen windows below; to say nothing of a blank pediment—typical, perhaps, of the state of sculpture in this country; of scaffold poles left sticking by way of *garde-fou* between the columns of the portico; of the dome, which looks about as elegant, though somewhat less droll, than the huge cowl at the Old Bailey. The York column was to have rivalled that of Trajan, but as it was found impossible to eke out the Duke's martial achievements so as to cover the shaft with them, that part is left quite bare: nevertheless, it is still, no doubt, the express image of its prototype. The Nelson monument—ah! what was the Nelson monument to have been, or rather, what was it not to have been? There we were told to anticipate a work, of which English art would have reason to be proud. "All the talents" were called out on that occasion, and we have got a tolerably decent model of one of the *five* orders, upon the top of which, Nelson will look like the wick of a candle burnt down to its socket. Again was public expectation raised to the highest pitch: the new Royal Exchange was to be a phœnix—in more senses than one—an edifice worthy of the first country in the world, and of the dignity of the City of London.—Well, if it should not exactly answer to our ideas of what is worthy of the first, it will doubtless amply redeem the promise put forth for it as regards the last, since should it *turn out* to have a more shop-keeping than dignified physiognomy, all the more characteristic may it be of the *dignity* of the City.

II. Hardly will his letter to the *Athenæum* obtain for Professor Cockerell a benediction from Professor Pugin; neither is it likely to be much better relished by Puseyites, Camdenists, and "Ecclesiologists," and whatever other *ists* there may be of the same kind. "Until the subject of our ancient architecture is studied," says the Professor, "the true spirit and intention of that architecture will

never be understood; and it will then, possibly, be found, that the intercessions of saints, and the pride of heraldry, are not in accordance with the free spirit of a Protestant, and a free people of the 19th century; and we may then shake off this *dull, unmanly copyism which disgraces our school*, and daring to think for ourselves, *invent* and *perfect* an architecture suited to the ideas religious and moral of our times, and in accordance with the materials and structure of an improved practice!" There's heresy for you, with a vengeance! What say you to that Joseph Gwilt? Why, the smallest of the "small-fry" could have uttered nothing half so mischievous and vile! *Invent*, indeed!—*perfect* too! By the beard of Vitruvius—if he wore one—it is truly scandalous.—"Dull, unmanly copyism!" What say you to that, Sir Robert?—the audaciousness of it must make your hair stand on end. What say you again, Friend Welby, to that same fling at "copyism," and the expressive hint, that the spirit of our ancient architecture is not exactly in accordance with the spirit of the 19th century? Well, after all, you have reason to comfort yourselves that Cockerell did not have a fling at Lord Shrewsbury and his "Inspired Virgins," who turn out, it seems, to be just what might be expected of miracles and miracle-mongers in this 19th century.

III. Architectural painters and draftsmen are privileged, it may be presumed, to lie with impunity, a licence of which some avail themselves so freely, that some of their productions are no better than so many downright graphic falsehoods, which, by greatly exaggerating or flattering the buildings so shown, cause disappointment when we afterwards behold them. It is a very common mode of lying, with them, to draw their figures, which should always serve as a faithful scale to the architecture, so much smaller than they ought to be as to convey the idea of the buildings being very much larger than they really are. Another common piece of deception is to throw in forced effects of light and shade that are never to be seen in the real objects. By no means is it an uncommon trick to put in, not merely positive, but most violent and exaggerated shadows on the upper part of a building, while all below is quite light;—shadows which we must suppose are occasioned by a score of balloons hovering over us just up in the air.

IV. It was to be hoped that the invention of the Daguerréotype would ere this have been turned to a very great account for the study of architecture, and have been made to supply us with perfect and trustworthy representations of buildings, more especially of such as have not yet been represented at all. With regard to subjects of the latter kind, this does not appear even likely to be the case. Certainly it is not so with the "*Excursions Daguerriennes*," for there some pains seem to have been taken to select some of the stalest subjects possible, and to avoid any which in addition to their intrinsic attractions, would have those of novelty and freshness. This is rather—or more than rather—provoking, so exceedingly perverse, in fact, that one is quite puzzled to account for it. Those who provide the engravings for the large sheet almanacs, seem to have the same relish for staleness of subject The Cambridge almanac for this year has an interior view of the hall of Trinity College, instead of the façade of the new Assize Courts, as might have been expected, and which, shown upon that scale, would have formed an interesting architectural plate. Again, there has been so very little building going on of late, and that little so undeserving of their notice, that the "Stationers" have been obliged to go to Greenwich Hospital for the subject of the engraving to their almanac. Well, some fifty years hence, perhaps, the turn will come for Cockerell's Sun Fire Office, and Moxhay's Commercial Hall.

V. A sort of materialism seems to be just now prevailing in architectural doctrine, that is more likely to give us able builders and cunning "artisans" than real artists in their profession. No doubt, in a merely utilitarian point of view, it is far more important that we should have the former than the latter. Art may be dispensed with, or treated as something altogether subordinate; but then let us, in fairness, abate our claims in behalf of architecture itself, as one of the fine arts, and to which, in its quality of such, we look for æsthetic charm and power. "Mere builders," is quite as strong a term of reproach as "mere artists;" and is one by very far more generally applicable than the other, since there are but comparatively few in the profession—and not everyone among the professors themselves—who show themselves to be artists at all; most of them being no better than respectable copyists and plagiarists, unable to catch the spirit of their models, and both preserving *that*, and combining with it some spirit of their own, to give us some fresh ideas worth having, and produce works that might deserve to become models in their turn. It must be admitted that the studies belonging to an architect are very multifarious; yet, while undue stress is laid upon some, which, after all, are but means—the mere scaffolding of his art—that which is assuredly not the least important among them is overlooked, namely, the study of *design*, by which is to be understood something more than that mechanical species of it, which may be learnt *secundum artem*. "But," say the feeble and the timid, "it is safer to stick to mere rules: to pretend to deviate from them, and aim at originality is very presumptuous, and moreover, exceedingly hazardous and dangerous." No doubt: yet it is by that daring which some call rashness, that glory is won, and through perils and hazards that conquest is achieved—in art as well as in arms. Of course those whose valour and prowess are calculated for nothing more arduous and perilous than a sham fight or review, do well to abstain from entering a field where only master-spirits may hope to win, and where even they may fail and fall.

VI. Greatly do I envy Professor Donaldson the possession of that pair of spectacles, which enables him to discern "lines of palaces at Pimlico and on the north side of the New Road," and magnificence in Regent Street! George Robins could hardly have been more liberal of praise in one of his puffing advertisements; and from him such puff would have been received for just what it is worth; but from a Professor and *ex cathedra!* it is *un peu fort*. Such excessive liberality on the part of the Professor at University College, is the more remarkable, because he could not find even one syllable of praise to bestow on a certain building in Gower Street, which some hold to be a very fair piece of architecture, although they are so fastidious in their taste, as to have no admiration for Pimlico palaces—not even for *the* palace, and for Regent Street magnificence. Perhaps the Professor was afraid of alluding or calling the attention of his auditors in any way, to the portico of the building they were assembled in, knowing that its columns had been compared by one very great authority in such matters, to "Ten Cyprians," a class of ladies that ought not to be allowed at Colleges and Universities. As to the great critical authority alluded to—one, by the bye, who holds architectural criticism generally, in abhorrence, much as he has scandalized at "Wilkins' Corinthian Cyprians," he is quite enamoured with those of St. Martin's Church.

NEW ARCHITECTURAL SOCIETY EXTRAORDINARY.

Some witty but malicious wag has just been amusing himself by circulating a hoaxing *jeu d'esprit*, which imports to be a list of the officers of a new Architectural Society, and in so doing has made exceedingly free with many respectable names, attaching to several of them some of the most ludicrous titles imaginable. We suspect that it comes from some one who is no very great admirer of Mr. Gwilt and his opinions, for that gentleman's name stands very conspicuously at the head of the list, where he is sneeringly designated "Professor of *Latin* architecture,"—a style of architecture never heard of before —and as "Vitruvian Professor," which last title seems to be intended to be a double shot, and to allude contrastingly to Mr. Hosking as the "Anti-Vitruvian Professor," and therefore in Mr. Gwilt's opinion, a Professor of Architectural Heresy and Radicalism. Then we have Mr. Valentine Bartholomew, "Professor of Fruit and Flower-painting," —an odd sort of appointment in a college of architects; Mr. G. Aitchison, "Professor of Concreting and Opus Incertum,"—in which last there are, if no professors, plenty of practitioners already. How Mr. Billings will relish the title of "*Itinerant Delineator*," we know not;

but it is a tolerably safe one, since no one will care to rob him of it, the epithet being just next door to that of strolling player. Mr. W. Bartholomew is named as "Honorary Solicitor," and if by that is meant he is to do all the law business of the society "gratis for nothing," he must be a real phœnix in *his* profession—something more wonderful than all other Professors put together. We never heard, before, of "*Baptisterographer*," yet such is the high-sounding title conferred upon a Mr. W. P. Griffith. Besides these, there are a "Custos,"[1] a "Recorder," and a "Cataloguist"! Of Professors of one kind or other there are no fewer than eight; so that the title is likely to become quite a drug—so dog cheap that no one will think it worth having. But the drollest thing of all still remains to be mentioned: would it be believed that these professed and professing "Free-masons" have got a female among them, contrary to the well-known regulations of that mysterious craft? And what office does the lady fill? Is she their "Professor or Professoress of cookery." Oh, no! There would be nothing very ridiculous in that; especially as there is a "Gibbons' *Carver*," and there must, accordingly, be a cook to provide materials for him to operate upon. No, the lady's office is to be that of—guess if you can, but we defy you to do it; therefore not to teaze you any longer, tell you it is to be that of "Embroidress!" Think of Professors, and a Vitruvian Professor among the rest, being jumbled up with an "Embroidress"—alias a Professor of Millinery! O, Vitruvius, how art thou fallen! Dignity of Art, how art thou sunk!—so low that ne'er shall we be able to dig thee out again!

Not contenting himself with this bit of quiz, the author of it has very unceremoniously mentioned several gentlemen as individuals on whom it is proposed to confer Honorary Fellowships, and has even had the audacity to make free with the name of Charles Barry; which is certainly carrying the joke a little too far. He has also put down those of both Willis and Whewell, and we need not say very blunderingly, since the "Vitruvian Professor" holds their writings in such contempt, that he has thought proper to omit them in the list of architectural works inserted in his Encyclopædia. It being merry Christmas time, some license may perhaps be allowed to the jokers and lovers of fun; but we suspect that many of the parties who figure in this *jeu d'esprit*, will consider it very sorry fun—not at all better than a *fort mauvaise plaisanterie*.

[1] Quære, should not this be "Custard-maker?"

PRINTER'S DEVIL.

RESTORATION OF THE CHURCH OF SAINT MARY, REDCLIFFE, BRISTOL.

[It affords us much pleasure to be able to lay before our readers the following address of the Vicar and Churchwardens of the church of St. Mary, Redcliffe, Bristol, on the proposed works necessary to be done to restore this noble specimen of ecclesiastical building to its pristine grandeur; and we are happy to see that the combined talent of Messrs. Britton and Hosking have been engaged to report upon the necessary works requisite to be done: the one is well known for his antiquarian disquisitions and his love for all that concerns the Christian architecture of Great Britain, and the other for his thorough knowledge of construction and architecture, which insure that the public will have that justice done to the building that it so well merits. We heartily join in the appeal, and do hope that every architect will exert his influence, in stimulating the public to come forward with subscriptions, for the restorations requisite this noble edifice.]

THE VICAR, Churchwardens, and Vestry of the Parish of St. Mary, Redcliffe, having resolved upon a public and extended appeal on behalf of the venerable and once splendid fabric entrusted to their care, prepared and circulated, in July last, an address briefly stating the circumstances which appeared to them to justify such appeal. That address explained the preliminary steps which the parish authorities had adopted, and especially their selection of Mr. BRITTON to advise respecting the decayed state of their church, and the best mode of restoring it to its pristine integrity and beauty, with their reasons for such selection. The result of their communication with that gentleman was his calling to his aid Mr. HOSKING, Professor of architecture and of the arts of construction, at King's College, London, whom the Vestry, at Mr. Britton's request, have associated with him in the commission.

These gentlemen having carefully and fully surveyed the church, presented to the parish authorities luminous and detailed reports, on all the matters referred to them, accompanied by plans and drawings illustrative of their views. In the conclusion of their preliminary address the parish authorities stated that the reports were thought too copious for printing on that occasion; but that in a subsequent appeal, an analysis should be given, to embrace their more leading and prominent parts, and illustrated by copies of some of the drawings. It is in fulfilment of this intention, and of the pledge contained in their former paper, that the Vicar, Churchwardens and Vestry, now present this more extended address, in the hope and belief that the public will feel as well satisfied as the parish authorities in their preliminary address stated themselves to be, that the able and eminent architects alluded to, have, in their consideration of the matters referred to them, "been governed by views not less honourable to their reputation for taste and science, than for sound and practical knowledge, and that could the views of those gentlemen be carried out, our city would possess a parochial church, and the west of England a national monument, of unequalled beauty, and one to be visited and admired by multitudes of strangers of our own and of foreign nations."

In their reports on the present state and contemplated repairs and restoration of the church of St. Mary, Redcliffe, Messrs. Britton and Hosking commence by drawing the attention of the parish authorities to the injuries sustained by the fabric, from the long-continued access of damp and moisture, both in the superstructure and foundation walls—produced, as to the *former*, by the insufficient means for carrying off the rain and snow—and, as to the *latter*, by the want of drainage; both which deficiences they principally ascribe to the original arrangement for the discharge of water from the roofs, and want of drainage round the fabric. To the former of these defects, they attribute, in a great degree, the injury to, if not destruction of, the external faces of the Masons' work upon the walls and buttresses. They have, in much detail, set out the nature, extent, and causes of the mischief; and, in a subsequent part of their report, have suggested, with like detail, the extensive and efficient measures recommended for remedying the evils alluded to, and for preventing their future recurrence.

They describe the *roof covering* as, throughout, in a very defective state, though heavy expence is annually incurred in repairing it; and they suggest its entire re-arrangement and re-construction, upon the principles described in their reports.

They have also ascertained and have very accurately described, an original defect existing in the great tower, evinced in a bulging outwards of the external faces of that part of the structure, and produced by an inequality of strength and resisting power between the finely-wrought and closely-jointed masonry of the faces, and the rubble backing which constitutes the main bulk of the walls; and they state that, with the exception of the tower and the flank wall and buttresses of the south aile of the chancel, all the walls and foundations, throughout, appear to be perfectly sound and but little injured They attribute the settlement outwards of the flank wall first noticed to the want of proper drainage before alluded to, and to the too near approach of graves to the foundations of the wall in question, which are not, in that part of the fabric, more than four or five feet in depth;

and they state that, by an attempt formerly made, to prevent the flank from going further, or to hold it up, mischief has been occasioned to the pillars which stand between it and the chancel, and, through those pillars, to the clerestory resting upon them. They express their opinion that the chancel is in an insecure state therefrom, and point out in very strong and clear terms the mischief and danger to be apprehended, unless immediate attention be given thereto; and they enter, at considerable detail, into the comparative inefficiency of the repairs which have been from time to time effected.

Recurring to the tower, they state, that the solid structure of this beautiful work is generally sound and trustworthy, though its *exterior surface has almost wholly perished;* and that from the dilapidated state of the whole exterior and especially of the enrichments previously noticed by them, the tower is unsafe to approach; and they therefore recommend means for excluding persons from passing within reach of the danger to be apprehended from the constant liability of fragments of stone, of no mean size, to become detached, and to fall in every direction.

They represent the masons' work of the spire as generally sound, though the surface of the stone upon the exterior is rapidly disintegrating from the causes described in the report.

In proceeding to advise as to the solid and substantial repair of the fabric, in its more important parts and the restoration of the ornamental parts, Messrs. Britton and Hosking state that so intimate a connexion exists between the parts of such a building as that under consideration as to render what may appear to be merely ornamental in most cases essential to the stability of the structure—that they feel themselves compelled to report on these two heads together; and they furnish very able and sufficient grounds for their determination—but dividing the subject into two parts, viz.:—

First, the tower and spire—and second, the church with the lady chapel, the porches and other accessories.

With respect to the first, it would be injustice to the architects to give in any other language than their own, the suggestions they have offered, viz.:

"*The Tower and Spire.*—This singularly beautiful composition is altogether distinct in style and date from the Church, which has been added to it, and deserves, as it requires, to be considered. not as a merely provincial edifice, and far less as a simple parish steeple, but as a national monument, and in the first rank of the many noble structures of the kind in existence in this country. In magnitude it is exceeded by few; in destined altitude the larger Cathedrals alone would excel it; and in chaste simplicity of design, combined with elaborately beautiful, but subdued and appropriate, decoration, Redcliffe tower is surpassed by none; whilst it is pre-eminent in its position, on a lofty bank of the Avon, within the commercial capital of the west of England. We have already intimated, that the solid structure of the tower is sound and trustworthy, and that it is capable of being easily made to bear all that it was ever intended to carry. The structural arrangement of the tower itself, and of the existing portion of the spire, give the completest evidence that the original design contemplated as it provided for a spire of the form and proportion exhibited in the accompanying engraving of the church. It would appear, however, that when the church was built the idea of completing the spire was abandoned, as the south-western buttresses of the tower were reduced in projection, and otherwise altered to compose with the west front of the church—and the south-eastern angle was altered, throughout, to extend the nave of the church uninterruptedly to its western front. The tact and skill with which the outer, or south-western angle of the tower was altered, and the fine taste with which the turret pier, in front of the church, which composes with the reduced buttress of the tower, is arranged, to connect the parts of the composition, are most admirable; but not so the arrangement at the other angle—where a low, heavy arch, and an unmeaning blank, upon a heavier pier, obtrude themselves immediately within the church door—contrasting, most disadvantageously too, with the composition of the arches of the aile, and with the clerestory on the other side of the entrance.

"It may be remarked here, that, at the time Redcliffe church was built, the taste which produced the original design of the magnificent superstructure to the tower no longer existed; spires were not built to Gloucester cathedral nor to Bath Abbey church, in the 15th century—as they had been at Salisbury, Norwich, and Litchfield, in the 13th and 14th centuries; comparatively small spires, on lofty towers, as at Louth and Newcastle—or lanterns, as at Boston, indicate the prevailing taste, in that respect, when this church was built, and the abutments of the spire of the original design were altered or removed. In this manner the incomplete or demolished spire was left, and the original composition was shorn of its fair proportions.

"In compliance with the instructions to us, to advise as to such alterations in the restoration of the ornamental parts of the fabric both external and internal as may seem necessary for reinstating it to its ancient and pristine beauty, we urge, most strongly, the necessity of restoring, at the same time the perished surfaces of the tower, and its immediate accessories, adapting it to receive the completed spire, and carrying on, to completion, that beautiful feature of a masterwork of architectural composition, which, in its truncated state, is but an unpicturesque deformity. Thus the original design may be both restored and completed, and Bristol possess a noble national monument, that will add to the beauty of her locality and to her pre-eminence amongst English cities.

"In restoring the tower, as contradistinguished from the superimposed spire, it will, of course, be proper that the work should be set upright on all its faces; and, in doing this, it will become necessary to take out and reinstate the whole of the ashlaring of the surfaces, even when it might otherwise remain, though that, indeed, is of very small extent. Moreover, all the stones upon which the enrichments occur must, of necessity, be drawn, wherever the enriched surfaces are defective, and these requirements together would involve the reinstatement of all the external surfaces of the tower. Paring old work, and pinning in patches of new stone, where there is not any left to pare, we consider altogether out of the question—as paring would reduce the original proportions of the design—and pinning in, among the pared faces, pieces in the place of stones altogether ruined, would not produce a restoration of the fabric to its ancient and pristine beauty. The absolutely necessary restoration of the faces of the tower, with its buttresses, turrets, pinnacles, niches, canopies, pediments, windows, and their enrichments, parapets, cornices, and corbels, will give the means of doing all that is necessary, with a trifling exception, to fit the tower to receive the spire of its full dimensions. This exception involves an alteration within the church; but we shall be able to show that what is required there can be made, not only consistent with, but most desirable for, the services of the interior.

"The existing portion of the spire is, fortunately, quite enough to give the means of developing the original design, whilst it affords demonstrative evidence that a complete spire was contemplated by the original designer of the structure. If lines be drawn from points within the footings of the buttresses of the tower, through the base of the spire, on the summit of the tower, they will follow the sides of the spire, as far as it now exists, and meet at such a height as similar compositions of equal date would justify by analogy. We have drawn such lines, or rather we have set up the present compartment, as it exists, and find that its thrust is within the abutments afforded by the buttresses, and that the sub-structure generally has the strength necessary to carry the superstructure resulting from carrying it up to the height indicated; which height results from a continuation of the same lines upwards, and is further justified by the best existing examples of works of the same class.

"The decorations of the spire, as it exists, are of singular beauty and propriety; the ribs are exquisitely moulded, and the characteristic enrichment of the vertical and pointed mouldings of the tower below, is carried with great good taste and beautiful effect up into the spire, so that nothing has to be imagined in that respect; and we may say with confidence, that the de-

sign, as we present it, of the tower, with the restored spire, is a true presentment of the original intention of the first designer. We may have omitted to state hitherto, however, what is most satisfactory to know, that in the midst of the dilapidation and disintegration which pervade the work, *nothing in the moulded forms or other enrichments, and nothing in the forms and proportions generally, is entirely lost; but specimens remain, from which restorations may be made with certain truth.*

"It will be remarked, that the basement of the tower, in the drawing of the elevation of the west front, shows a greater depth of faced work than appears at present. This we consider it desirable to restore, to prevent the structure from losing any part of its apparent elevation, in raising the level of Redcliffe Street before the north-west entrance to the enclosure; and we have suggested, in the drawings, a re-arrangement of the steps of approach to the church, in accordance with this view. We propose to alter the windows of the tower, from their present forms and proportions, to others, more in character with the design of the superstructure."

For the reasons detailed in the report, Messrs. Britton and Hosking recommend that attention should be *first* directed to the restoration of the *tower and spire;* and that the former should, under the circumstances, not be deferred any longer, if it be desired to preserve this beautiful monument from utter destruction.

Speaking of "the church, with the lady chapel, the porches, and other accessories," after the recommendations before alluded to, as to what are termed the hydraulic arrangements and the proposed reconstruction of the roofs—Messrs. Britton and Hosking suggest a new gateway at the north-west corner of the church enclosure, and other arrangements consequent upon the recent alterations under the Bristol Improvement Act, and for giving more effect thereby to the beautiful edifice under consideration; and, after their valuable suggestions for the substantial repair of the fabric, in the south flank of the chancel and the transept, they refer to their drawings, as showing with sufficient clearness the restorations they propose of the various parts of the exterior of the building; which restorations, they state, are mostly from existing authority within the building itself—and where no specimen exists of the original parts, the restorations are stated to be made, to the best of their judgment, from analogy. Repeating their difficulty of separating the substantial from the ornamental parts they go on to show that many portions commonly considered merely ornamental are either absolutely necessary, or highly useful, to the substantial structure; and after naming several instances of this sort, they add:—

"We do not contemplate, however, and cannot imagine that the necessary and useful reparations are required to be made in merely shaped blocks of stone without the mouldings and other decorations appropriate to them; and, for ourselves, had rather see the church a picturesque ruin, than be instrumental in restoring it to strength without its native beauty. We propose, therefore, *the restoration of all the decorations that ever existed upon the surfaces of the work,* and that with new materials, and not by paring and patching the old."

They add, however, that, in some few cases, the heads of the windows, with the tracery in them, may, perhaps, be preserved.

The architects propose to move the modern attachment to the south porch, also the lobby to the lady chapel, and likewise the sheds and other unsightly objects about the church, and of the doorway and steps at the south-east side of the north porch; they further suggest certain provisions and restorations consequent on such removals.

AS TO THE INTERIOR OF THE CHURCH.—The suggestions of Messrs. Britton and Hosking refer to matters of which they describe the restoration for the most part as easy. But the most important restoration of the interior is that at the east end, involving the removal of Hogarth's pictures, and other inappropriate attachments, and the reinstatement of the east and clerestory windows; and they hope to find that reparations only will be wanted to the *screen, between the chancel and the lady chapel.* The latter will want certain alterations, including a new floor.

In the restoration of the spire will be involved some alterations, pointed out by them, at the west end of the church, including a new arrangement for the organ; and they express their hope, that as the whole of the lead and glass must be removed from the windows for the restoration of the mullions and tracery, it may, in the principal ones at least, be reinstated with *stained glass* of an appropriate character.

They also propose in detail numerous and important alterations in the re-arrangement of the *pews and seats,* by which, with an increased seat accommodation, and better command from the pulpit, reading-desk and altar, a more perfect view of the building may be obtained, whilst all the beautiful pillars shall be in every case insulated, that the eye may range over their lofty and symmetrical forms and proportions, from the base to the summit.

The reports of Messrs. Britton and Hosking, with their accompanying drawings, though (for want of more time and labour than they have yet been able to bestow) not made with the fulness of detail required for actual operations, are, nevertheless, the result of admeasurements and of careful delineation of the most important parts; and their observations arise from close examination of the work in general and in detail, upon personal survey and attentive study and consideration of what they have observed; and their *estimates* subjoined are the result of such survey and consideration, and also upon comparison with the cost of other large works of analogous extent and character.

THE TOWER AND SPIRE.—The complete reinstatement and restoration of the tower with its pinnacles, and all its decorations, in the manner, and with the stone they contemplate adopting, will cost about £8,200.

The re-construction and completion of the spire, according to the data afforded by the existing portion thereof, and according to the drawing of the west front restored, and making the requisite additions to the buttresses of the tower, and including the scaffolding and machinery necessary, will cost about £3,600.

THE CHURCH, with the lady chapel, the porches, and other accessories:—

1st.—*The hydraulic arrangements,* including new roofs to the church and lady chapel, the re-arrangement of the north-west approaches, with the earthwork, drains, &c., as recommended in their general report, after giving credit for old materials, will cost £1,850.

2nd.—The substantial repair and reinstatement of the *interiors*, and the repair, reinstatement, and perfect restoration of the whole of the *exteriors* of the church, lady chapel, and porches, including the re-working of the whole of the external decorations in the stone alluded to, together with the alterations and presumed improvements recommended in the general report, it is estimated will cost nearly £21,400.

3rd.—The re-arrangement and refitting of the interior of the church as proposed by Messrs. Britton and Hosking, will cost £2,600. *The whole* presenting a total outlay of £37,650, which, with a due estimate for *contingencies*, in works so extensive, and of such comparatively novel character, cannot, in the judgment of the parish authorities, be safely calculated at a sum much less than £40,000.

It is, however, stated by the architects, that the expense under the 2nd head may admit of reduction, by their finding, on further examination, portions of the work capable of remaining, or of being re-worked and re-applied in places less exposed to the weather, and it is their opinion, that the part of the work contemplated in this section may, after precautions are taken to secure it, generally be distributed over any reasonable number of years.

In allusion to the large sum required for effecting the object in all its proposed details, the parish authorities can but repeat, in the language of their preliminary address, that such an amount is only to be raised by the liberal co-operation of those whom providence has

blessed with the ability and the desire to aid in such objects as that for which this appeal is intended; and upon those of our own locality who have been so favoured by providence, they repeat their confidence, that an appeal will not be made in vain for the restoration of a fabric, which, if not wholly the work of a Bristol Merchant, is to be ascribed principally to one of that class. Their confidence is strengthened by the able and energetic support they have received from many and influential quarters, and especially from our local press, by one of whose editors it has been well and eloquently said, that "the question for the public—for the church-going public in particular—to answer, is,—Shall decay be suffered to proceed until restoration shall have become impossible? The amount required (£40,000) for the complete repair of the fabric is certainly great, but when we recollect the large sums which have been raised for the restoration of Hereford Cathedral, and of York Minster, we cannot doubt that the nobility, gentry, and wealthy commoners of Gloucestershire, Somersetshire, and the neighbouring counties will evince equal liberality in worthily upholding—

"The pride of Bristowe and the western land."

The parish authorities, whilst they feel that they cannot, with propriety, divest themselves of the responsibility of carrying out, so far as they shall be enabled to do, the repair and restoration contemplated, feel sensibly that the public, from whom the means of accomplishment is so largely to be drawn, are entitled to every reasonable security for the due appropriation of the sums contributed, and it is therefore the desire of the parish authorities, at an early period after any considerable subscription shall be obtained, to convene *a meeting of the subscribers*, by the majority of whom, subscribing not less than £10 each, six contributors of not less than £50 each shall be chosen, who, with the members of the vestry for the time being, shall form a committee for carrying out such repair and restoration, and for controlling the monies received, and the expenditure thereof.

The parish authorities in aid of the object intended, propose to anticipate, as far as they possibly can be advised to do, the revenues of the estates vested in them for the repair and support of the church, and by means of which, that object has been hitherto (however inadequately) accomplished without the parish having been ever burdened by a *church rate*, and from this source they will apply the sum of £2000, to be paid, as they propose the individual contributions shall be paid, by five equal and successive yearly instalments, to meet the expenditure as it will probably annually progress.

In conclusion, the vicar, churchwardens and vestry, of St. Mary, Redcliffe, venture to quote and apply to their church, the language used by the learned and Very Reverend the Dean of Hereford, in reference to his own cathedral, which at the present moment is in a dangerous state; but which is likely to be preserved and renovated by the united efforts of the benevolent friends of the church and of Archæology.—"Restoration, is the grand object to be achieved, not mending and patching." * * * * * "I earnestly intreat that restoration may be regarded as the one thing sought—sound and legitimate restoration, for which there is sufficient authority."

To the preceding appeal the parish authorities append the following remarks and suggestions by their senior architect, who, as an antiquary and author, has laboured nearly half a century to elucidate and illustrate the ecclesiastical architecture of Great Britain.

M. R. WHISH, *Vicar.*
THOS. PROCTOR, } *Churchwarden*
JOHN FARLER, }

EXTRACTS FROM THE REMARKS AND SUGGESTIONS BY MR. BRITTON.

To those persons who are not acquainted with Redcliffe Church, it may be both interesting and useful to give a short account of its peculiarities, beauties, and historic annals.—As a parochial Christian temple it is acknowledged to rank, if not the first, at least in the first class, amongst the many fine sacred edifices of our country. As compared with the cathedral and conventual churches of England, it surpasses most in symmetry of design—in harmony and unity of character—in rich and elaborate adornments—in the picturesque composition of exterior forms and parts—and in the fascinating combination of clustered pillars, mullioned windows, panelled walls, and groin-ribbed ceilings of the interior. I know of no building, to compare with it in all these features, in Great Britain, and I feel assured that there is none superior in graceful design, and beauty of detail, in all civilized Europe. Except the cathedral of Salisbury, which is nearly of one age and design throughout, the other cathedrals, and indeed most of the large parish and conventual churches, consist of heterogenous parts, of varied and discordant dates and styles.

The accompanying views of Redcliffe Church, though on a small scale, cannot fail to impress every eye that can see, and every mind that can appreciate the beauties and merits of architectural design, that the church, now fast approaching ruin, was once, as it may again be made, a splendid edifice; a temple eminently adapted for the soothing and sublime devotions of Christian worship, and also calculated to impress every spectator with wonder, delight, and admiration.

The architect and the antiquary who read plans and sections of buildings, as the musician reads notes, will instantly perceive, that the church referred to is systematically and beautifully arranged; that its interior abounds with clustered pillars, and richly-ornamented ceilings: that its walls are pierced with large windows, divided by mullions, and strengthened with buttresses to resist the thrust of the arched ceilings; that it has a transept of unusual design, being divided into three nearly equal parts; that there is a presbytery, or chancel, with ailes, divided from it by richly-devised screens; that there is a lady-chapel, east of the chancel, separated by another open screen; that there are two small apartments, for a resident chantry-priest, north of the chancel-aile, in one of which is a fire-place, showing it to have been a dwelling, the whole being of unusual occurrence; that there is a double porch on the north flank of the church, manifesting in form, style of walls, ribs, and stairs, different ages of erection; also a porch on the south side, differing, again, from the double north porch in every respect; that the wider and stronger walls at the north-west angle of the plan, show the foundation of a tower; that there is a doorway for entrance at the west-end, central to the nave; and that different flights of steps, from north to south, traverse the west-end, and show that the ground ascends, quickly, in that direction. Aided by the accompanying engravings, of a view of the church from the north-east, and interior; any person may readily understand the architectural characteristics of the church referred to; and those who have studied Christian architecture will immediately perceive its peculiarities of form and arrangement, as well as the chaste profusion of its ornamental details.

Although essential and substantial repairs and restoration be the main objects in the contemplated works, these will be applied to the interior even more than to the exterior of the building; for if the latter may be regarded as the shell, the former is the kernel—if the last be the case, the first is the jewel intended to be preserved. Indeed, as the inside of Redcliffe Church was in its original and finished state an architectural design of pre-eminent richness and beauty—as it was destined by its founder and architect to surpass all its neighbours in originality of composition and elaborate finish, so was it adapted to satisfy the wants and wishes of those for whose devotions it was intended—the present architects, emulous to follow such example, propose to render it fully and completely adapted for the rites, as well as the habits, of its protestant occupants. In doing this, they consider it material to provide accommodation for the many, rather than merely to please the few; they think the clergyman and his congregation should be in such close communion, that the former may be seen, as well as heard by the latter. If the numerous shafted

pillars tend to interfere with this communion in some degree, the few sittings, so placed as to be out of view of the minister, will only be resorted to on emergencies. In designing and disposing the altar, the desk, and the pulpit, the organ, and the font, as well as the required number of seats, the most scrupulous attention will be paid by the architects to the ancient usages of the Anglican church, and they confidently anticipate many striking and beautiful scenes and effects when the whole is completed, the subordinate appendages being made to correspond and harmonize with the architectural disposition and character of the church. A learned and travelled clergyman who has devoted some years to the study of the church architecture of the middle ages, writes to me thus—"The harmonious effect of Redcliffe Church must at one time have been quite unrivalled. I am not aware of any cathedral or parish church, either in England or abroad, that contains an equal amount of rich and uniform vaulting. The bosses, more particularly, both in quality and quantity, surpass all that I have met with elsewhere."

To accommodate and afford every degree of comfort to even larger congregations than have generally assembled within the walls of this church, we have made such arrangement of the seats, as shall bring all persons more fully and freely within sight and hearing of the minister; and have also taken especial care to display the complete height and design of all the graceful clustered pillars of the edifice.

There are four palpable varieties of Christian architecture in Redcliffe church, manifesting as many architects, and as many different times when they were respectively designed and erected. The inner north porch, or vestibule—the tower and spire—the outer north porch—the body of the church, with the lady chapel, and the south porch—we feel assured were built successively, and it is generally admitted, that an older church was removed to give place to the present nave and chancel with their ailes and the transept. The oldest of these members, *i. e.* the vestibule, is of a date between A.D. 1200 and 1230. "In 1207 Lord Robert de Berkeley granted to Redcliffe church, at the request of William, the chaplain, his fountain of water from Huge well, for the friars of St. John the Baptist in Redcliffe." Lands were conferred on the same church, about that time, plainly showing that there was one then in the parish. The tower and spire we may safely refer to the reign of Edward I, as corresponding with known specimens of that age. According to the chronicles of Bristol, Simon de Burton, who was mayor in 1293, "began to build the church of St. Mary de Redcliffe, when John Lamyngton was chaplain,"—(Evans's "Chronological Outline.") Seyer, in his "Memoirs of Bristol" (Vol. II., p. 77) from MS. Calendar, more cautious and particular, says, "It was about the year 1293 or 1294 that Simon de Bourton, a person of wealth and consequence, who was Mayor of Bristol in that year, and bore the same office six times, built the church of St. Mary, Radcliffe, where the eastern end now is." Here we find it positively stated by one writer, that the church was built, and by another that it was begun, at the above date. To us it is quite clear that no part of the present church is so early as 1294.

YORKSHIRE ARCHITECTURAL SOCIETY.

Sir—My attention has been drawn to a letter in the last number of your *Journal*, containing remarks on the Yorkshire Architectural Society. What is *personal* in the letter may be safely left unanswered, as the tone in which it is written will be its best counter-agent.

With respect to the Society, your anonymous correspondent has made several statements, of the falseness of which I hope he was ignorant; these appear to require some notice.

In his letter, it is said "The prospectus contains the names of two architects only, and neither of them attended the Autumn meeting."

Before the Autumn meeting, the prospectus contained the names of *twelve* architects; I saw four present at the meeting, and I believe more attended.

Your correspondent says, "*Two meetings* are to be held in the year, and from the information given at the last, it appears, that for general accommodation, they are to be in the remote corners of the country."

Two *general public* meetings will be held during the year, the places of meeting being *various*, and appointed by the Committee, so as to suit the convenience of the members generally.

Again. "All admitted must be members of the Established High Anglo-Catholic Church." It is true that this Society for promoting the study of *Ecclesiastical* architecture, admits only churchmen; but without respect to their peculiar sentiments. No exclusion of any member of the church has yet taken place, and the Society, amongst its 400 members, includes many churchmen of different opinions.

The last misstatement is, that "the standard for all buildings is to be Parker's Glossary."

At the request of a dignitary of the church, a list of elementary works on Gothic architecture was added at the end of the report, as a guide to any member beginning the study of architecture: in this list Mr. Parker's Glossary was mentioned, together with the works of Rickman, Bloxam, &c. This so far as I know, is the only foundation for the imaginative writer's assertion, "that the standard for all buildings is to be Parker's Glossary." Whether the insertion of such venturous statements on the authority of an anonymous writer suits the character of a respectable periodical, I leave to your judgment.

I am obliged by your having pointed out in your Editorial remarks an unintentional omission in the advertisement there alluded to. It was considered, or rather assumed without consideration, so much a matter of course, that the architect whose plan should be chosen, would have the carrying out of his design, that no express mention of this was thought necessary.

I am, Sir,
Your obedient Servant,
S. Wilkinson,
Hon. Sec. to the Yorkshire Architectural Society.

Leeds, Dec. 5th, 1842.

THE KENTISH TOWN COMPETITION.

Sir—Should what I am about to say appear too pointed against a particular party, that individual has mainly to thank himself for the pointedness of some of my remarks. When we find a man pursuing that very course which he has both loudly and publicly reprobated in others, and protested against—we must suppose, upon principle—when we see a would-be Cato all at once changed into a Clodius, such an offender has little reason to look for that lenity which might perhaps be extended to those, who, whatever their conduct may be, at least make no parade of being greatly more upright and conscientious than their neighbours.

That after expressing himself decidedly hostile to competition, after actually saying, "I have endeavoured to go into the *strongest possible condemnation* of which I am capable, of the depreciating effect of competition in architectural design;' that after thus pledging himself in print, and the strongest possible manner, to be opposed to the system of competition in any shape, Mr. Bartholomew should have become, or have even thought of becoming a competitor for the intended church at Kentish Town, is indeed most strange. He cannot disavow those words, and a great many others to the same effect, unless he should now choose to say, that although his name appears upon the titlepage, he is not the *bona-fide* author of the work; and did not even know until after its publication, what opinions it really contained; yet hardly will he resort to such evasion. He must therefore put up with the mortification of having been so imprudent as to publish a good many very harsh reflections that now recoil upon himself. Hardly is it possible to conceive how a man who has denounced the whole system of competition in the most unmeasured—even virulent terms, as one compounded of folly and knavery, and which he accordingly laboured earnestly to put down, should now abet it; should not only join in a public competition, but in doing so, should unfairly evade the restrictions laid upon others, having good reason to know that his doing so would be winked at.

In the list of printed conditions, one was to the effect that none of the drawings sent in should be *coloured*, but merely tinted in sepia. This was sufficiently explicit; there was no possibility of mistaking it. Nevertheless, Mr. Bartholomew's principal elevation was a coloured drawing; and so far he violated the instructions which his rivals had been obliged to conform to: consequently he ought in justice to have been put *hors de combat* at

once. The best that can be said in excuse for him in that matter, is h so far he practised no deception, for the most ignorant set of men must have been able to see whether a drawing was coloured or not, and if they choose to violate the pledge implied in their own instructions to the competitors, the dishonesty rests with them. At any rate *they* have no cause to upbraid Mr. Bartholomew with having acted unfairly. But there was one little *licence* of another kind taken by Mr. Bartholomew, by which they were probably imposed upon. I here allude to the singular discrepancy between the geometrical elevations and the perspective view, in which last, several alterations were made, in order to *improve* the effect. Improvement there was, but it was also direct *falsification*. It was tantamount to saying, "execute the building from this set of designs, and such will be its appearance." And if that does not amount to one of the *tricks* practised in competition, I know not what does. By no means do I pretend to say that Mr. Bartholomew is indebted for the decision in his favour, mainly to that artifice. He would probably have been equally successful, had he taken the liberty of evading the condition which required perspective drawings. I merely mean to say that such artifice was actually practised; and by whom? —by no other than the immaculate and conscientious Mr. Bartholomew, the violent and ultra anti-competitionist, who, in another edition of his book—should it ever reach one—may now bring forward some examples of the manoeuvres practised in the competition for the Kentish Town Church.

Without any additions, however, there is enough and more than enough in his book at present, to convict the author of the "Specifications" of the most flagrant inconsistency. Or are we to suppose that he purposely left himself a loophole to creep out of, in the remark, that "what every respectable architect who has any real professional business to attend to, thinks of competition, may be gathered from the well-known fact, that none such is found to send in a competition design, unless he possess, or fancy that he possess, *direct influence for obtaining the prize!*" After this, we are compelled to suppose that Mr. Bartholomew would not have entered into the competition in question at all, had he not good reason to imagine beforehand that the prize would be secured to him by influence behind the curtain. It seems, therefore, after all, that violent as he is against competitions in general, he has no objection whatever to enter into one, provided he knows that it is a mere mockery—as far as others are concerned, and that however superior may be the merit of other designs, the preference will be awarded to his own! He has now put beyond all doubt that he had but one inducement, and that founded upon what is most corrupt in the whole system of competition; upon that which really brings it into disgrace, and renders it nothing better than a system of dishonesty and intriguing—where one is to be favoured, and all the rest are to be duped—being invited to throw away their time in making drawings for what is arranged and all but finally settled beforehand. In the Kentish Town affair, however, there is something to console those who have been duped and disappointed; for not only is it a consolation, but even a triumph to find that Mr. Bartholomew's anti-competition rigour has thawed and melted away—probably owing to the late very hot summer; and that he has to all intents and purposes publicly recanted the furious invectives he has uttered against competition in his book. Therefore, those last now stand for nothing—except as so many proofs of his singular sincerity and consistency.

I remain, &c.

No A B. [illegible]

THE INVENTOR OF THE DREDGING MACHINE.

SIR—I observe, with some surprise, from a review in your Journal of last month, that you still consider the claim of the invention of dredging by steam power to be amongst the number of those which are not yet satisfactorily established. You refer to a paper in the *Civil Engineer and Architect's Journal*, for January, 1839, wherein the invention is unreservedly ascribed to my grandfather, John Hughes, and during the four years which have elapsed since the publication of that paper, no syllable has ever been advanced in opposition to this claim—a fact which carries with it peculiar weight to the minds of those who, like myself, are fully aware of the very large circulation which your Journal commands. An individual, however, has at last thought proper to assert—I am willing to believe without the sanction of Messrs. Rennie—that the dredging machine is the invention of the late Mr. Rennie, their father, who first used it at the Hull Docks. In commenting upon this assertion, you observe truly, that a very important fact is not mentioned, namely, the year in which Mr. Rennie first introduced it at the Hull Docks. I shall, therefore, supply this omission in order that you, Sir, and the readers of the Journal, may estimate the value of the assertion thus rashly hazarded by a self-constituted champion of Mr. Rennie. It will be found that the first steam dredging engine employed at Hull was that used for cleansing out the Humber Dock, which was not opened till the 30th of June, 1809; and the following passage from Mr. Timperley's account of this dock will fix the time at which the engine was first used.

"This dock was not cleansed for three years and a half after it was opened, *the dredging machine and mud boats not being completed until then.*"[1] Hence it appears that the dredging machine could not have been employed at Hull before the end of 1812 or the beginning of 1813.

While this is the fact with respect to Mr. Rennie's claim, I am in possession of a report by my grandfather, dated in 1820, where he describes minutely every particular of his invention of the engine, and first employment of her at Woolwich, as far back as the year 1804; and not until it can be shown that the engine was invented before this last date will the claim of my ancestor be at all invalidated. I believe that Messrs. Rennie have far too high a respect for honour and truth to dispute for one moment a fact with which their respected father must have been so perfectly well acquainted, as that of the invention of the machine, and her first employment by my grandfather at Woolwich, in the year 1804. At the same time, it is possible that a person less intimately acquainted than they must be with the history of an invention of this nature, might be misled by the fact that dredging machines, on the old bag and spoon principle, were employed at Hull 50 or 60 years ago. It is even admitted, that a bucket engine worked by horses, was used at Hull from about the year 1782. This engine was probably the work of Mr. Rennie. That it bore no resemblance however to the modern steam dredging engine is abundantly proved by the fact, that many years after the horse machine was erected at Hull, the application of steam power to the dredging engine was unsuccessfully attempted by Trevethick and many other able engineers. Had Mr. Rennie's machine of 1782, been anything like the steam dredging engine, the simple application of steam could scarcely have baffled the exertions of so great a man as Richard Trevethick, with others of his contemporaries.

With respect to your observation "that the late Mr. Rennie, together with his talented sons, have brought the machine to that great perfection it has now attained," I would simply remark, that the engine built by Messrs. Donkin for William Hughes of Inverness, and used by him on the Caledonian Canal, was the most perfect ever constructed. See accounts of this engine in Baron Dupin's work on the resources of Great Britain, in your *Journal* for January 1839, and in a paper read before the Institution of Civil Engineers during the last session.

I am, Sir,

Your obedient servant,

8, Duke Street, Westminster, SAMUEL HUGHES.
December 15th, 1842.

AMERICAN MARINE STEAM ENGINES.

SIR—A late number of your *Journal* contained some remarks concerning American Marine Steam Engines, which were in a spirit very unlike the usual tone of the English press in descanting upon "Brother Jonathan's" available genius in such matters. Candid, fair, impartial criticism, no matter how close it may chance to "cut," will do much towards removing those mutual prejudices which unhappily exist to such an extent, that the mere impress of "American" or "English," is oftentimes of itself sufficient to place the merits of any work without the pale of respectful controversy.

This should not be; there is not the least of necessity or of policy in being thus deprived of the benefits of each other's experience; as advantages in some shape or other, most undoubtedly belong to each, and only require to be known in order to be secured. As an illustration, might be adduced the acquaintance already formed through the establishment of your Trans-atlantic Steam Navigation Companies. One or two instances will suffice. In the English marine engine we see a connecting rod 15 feet long, and 10½ inches diameter, subjected to the same direct stress with the connecting rod of the American engine, and which is 24 feet long and 6 inches diameter; two thirds *less in area,* and one third *greater in length,* and yet performing equally well the same labour! By this, we are taught, that

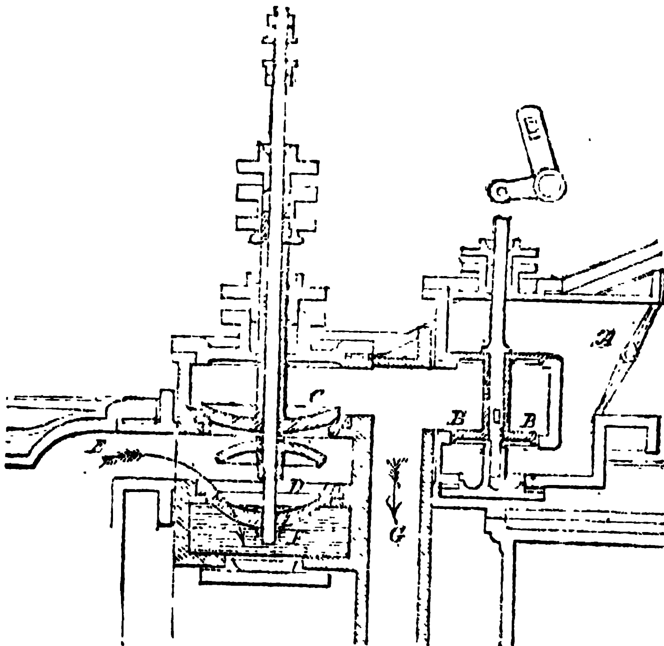
[1] See Mr. Timperley's account of the Harbour and Docks at Kingston-upon-Hull. Transactions of the Institution of Civil Engineers, vol. I, p. 22.

while the English engines are certainly at *one extreme*, we are probably at the other. Again; the *Great Western*, if you please, comes over here with decks as "clear" as a "man of war," and returns with the singular notion, that on her quarter deck, can be erected, at a trifling expense, a saloon equal in every respect—and superior in many—to the one below, and making an addition to her accommodations equal to one third of all her cabin room below deck!

Notwithstanding the unequalled degree of perfection to which steam navigation upon our rivers has attained—excepting, of course, the great river of the west—the impression is very prevalent abroad, that in the attempt to compete with the "Lion of the seas," we shall be found wanting—an impression unfortunately, most consistent with a certain illegitimate specimen of "Yankee enterprise," which has recently visited your shores. We think, however, that the time is not far distant when, with a ship exceeding in length the ordinary proportion, with engines having greater length of stroke so as to admit of working steam at a greater pressure without adding weight to the working parts, with paddle wheels large in diameter, very narrow, and making revolutions not less than 20 per minute; and with boilers adapted to a pressure of 15lb. to 20lb., we shall be able somewhat to "shorten the distance" which separates us from the "land of our fathers." Certain it is, that our ship builders and engineers will not be satisfied with a steamer which will require, on a passage to Liverpool, more than *ten days* of good weather.

You were pleased to notice in a favourable manner the engines of the Spanish steamers *Regent* and *Congress*, built by the late firm of Ward, Stillman and Co., of the Novelty iron works, New York, and to intimate a wish to have the details of their arrangement. In answer to which, I take pleasure in sending to you a detailed account of those vessels, together with so much of a drawing of their engines, as will answer the purpose of your inquiry, and which I am authorized to do by Messrs. Stillman and Co.

View of the Upper Valves.



A, Throttle valve. B, Expansion valve. C, Steam valve. D, Exhaust valve. E, Upper part of cylinder. F, Exhaust pipe. G, Steam pipe to lower valve.

Vessels:—	Feet.	Inches.
Length on deck	151	0
Breadth	30	8
Ditto at water line	28	8
Depth of hold	14	6.
Draft of water	8	6
Burthen	671 tons.	

Frame of white oak, live oak, locust and cedar. The floor of white oak, laid close and caulked inside and out. Planked with white oak; fastened throughout with copper thorough bolts, composition spikes and locust treenails.

Engines:—
Diameter of cylinders 42½ inches.
Length of stroke 4 feet 7 inches.
Diameter of paddle wheels 18 feet.
Length of board 7 feet 6 inches, and width 2 feet 6 inches.
Pressure of steam 10lb.
Number of revolutions per minute 26.
Total weight of engines, wheels and boilers 100 tons.
Two copper boilers 22 tons.
Length of boilers 14 feet, height 9 feet, and breadth 8 feet.
Total of fire surface 1400 feet.
Speed of vessels 10 miles per hour.
Cost of vessel, engines and boilers, about 150,000 dollars.

It would be trifling, I fear, with the patience of your readers, to enter into a detailed description of the drawings, representing, as they do—with one or two exceptions—but an "old acquaintance," the "side lever engine;" the principal deviation from which, is the steam valves, and perhaps the air-pump bucket. The valves are shown in the section in the same position as in the drawings you refer to as having received, and which has recently been published in the London *Mechanics' Magazine*. As to the merit of this arrangement of the valves, I will not now offer an opinion, except that they are not generally used here for large engines.

As English engineers—either from strict fidelity to the *opinions of Watt*, or from much actual *experience*—have held us guilty of divers "barbarisms," in our substitutions for the use of the "slide valve," I shall make this matter the subject of another communication, accompanied with a sketch of the most approved form of the "double" or "balance valve."

The bucket of the air pump, as shown in the separate sketch, for aught I know, may not be peculiar to this country, nor is it universally adopted here; it has been found, however—in situations where the condensing water is free from sand—to be far more efficient and durable than any other in use.

The "bilge injection," shown near the bottom of the condenser, is here thought to be an essential part of the engine of every steam vessel. And instances have occurred in which the use of it has been attended with the saving of much life and property.

With your permission, I will from time to time furnish your readers with notices—accompanied with drawings—of such improvements in American engineering, as may be thought interesting, or of such of its features as are not familiar to our transatlantic brethren generally.

I am, Sir, &c.,

New York, July 1842. F. W. S.

In our Journal for June last, we noticed that the Spanish government had ordered, and obtained from New York two war steamers, named the "Regent" and "Congress," and in commenting thereon we observed, we wished some further information before we gave any opinion on the subject; we were favoured with a lithographed external view of the engines, but we desired to look below the surface. Our wish has now been complied with, we are in possession of an apparently perfect section of the engines of the *Regent* and *Congress* steam ships, together with F. W. S.'s remarks thereon, and which we now publish. We thank him, and think, if his intentions are supported by engineers of the Old and New World, it will do much towards the explosion of prejudice, the extension of knowledge, and general good of mankind; that we heartily co-operate in this view, we plainly avow, as in fact our remarks in our last December number fully prove. We are, therefore, surprised at the opening paragraph of our correspondent, and we are unconscious of having admitted any thing into our columns which could offend his taste. If we have descanted upon "Brother Jonathan," it was more in playfulness than anger, not as an opposing race, but as descendants of one common stock, to which *genius* is common. We think, however, our correspondent's reprehensions are misapplied, as we do not recollect using the phrase he complains of. With this exordium we at once proceed to an analysis and consider tion of the engines of the *Regent* and *Congress*.

The engines are of the *beam* kind, and scarcely to be distinguished from those of the *Medusa* by Seaward, published by Weale in his Tredgold, pl. 49, vol. 2. The *architecture* is very similar to the engines of the *Tiger*, by Edward Bury. (See Tredgold, vol. 2, plates 110 and 110 a.) In one point they differ, in the use of circular valves instead of the D or Murdock slide, and in this it resembles another emanation of American intellect, called the *Royal William* (now *Isabella II.*) which made the voyage to England in 1832, and subsequently figured in the Spanish war.

The cylinders are $42\frac{1}{2}$ inches diameter and 4 ft. 7 in. stroke; at 26 strokes or 238 feet the power is equal to $71\frac{1}{2}$ horses each, or 143 horses collectively. This is nominal power as calculated by the rules of the late Mr. Watt, applicable to steam of $2\frac{1}{2}$ or 3 lb. per inch, but in this case we have a pressure on the safety valve of 10 lb. per square inch, so that the *actual* power will probably be 150 per cent. above this, depending entirely upon the [illegible]pansion used, and we may further observe, that with a suitable arrangement, circular valves may be made to produce any degree of expansion, at pleasure. The air pump is 22 inches diameter, and about 2 ft. 6 in. stroke, [illegible] a content of 6·6 cubic feet. Cylinder 42½ in. × 4 ft. 7 in. long [illegible] 49·46 feet content, which divided by 6·6, makes the cylinder 7·5 times larger than the pump, just the usual proportions of English engines. The condenser is 2 ft. 5 in. fore and aft, 3 ft. 5 in. in width, and 4 ft. high, with proper deductions is equal to a content of 24 cubic feet, and 71·5 ÷ 24 = nearly 3 cubic feet per H.P. The circular steam valves are $11\frac{1}{2}$ in. diameter = 103·86 area, the eduction valves are 10 in. diameter = 78·54 area, or rather more than a square inch per horse, a very ample allowance, and much exceeding Mr. Watt's rules, as will be seen by reference to Farey and other works, but taking into consideration the increased density of the steam employed, is judicious, and about on a par with modern *slide* valve practice. Our correspondent is wrong in supposing that English engineers have adhered to the slide valve "from strict fide[li]ty to the opinions of Watt." It is otherwise; they have departed therefrom and followed Murdock, his disciple, who patented the D, triangular, or other shaped sliding valve, in his specification of 1790. (See Farey, p. 677.) We are at a loss, also, to find any novelty in the construction of the circular valves; they appear to us precisely similar to those used by Mr. Watt[1] in his engines of 1808. He used circular pipes, and here we have rectangular passages. (See Farey, plate 20.) We are equally obtuse respecting the air pump, of which we have an isometrical drawing, and can find nothing new therein; if our correspondent alludes to the packing ring similar to that of the piston, we may say that system has been followed in this country since the year 18[illegible]6, perhaps earlier. The bilge injection is in the same category.

There is merit in the adaptation of a double beat expansion valve, though it is by no means new, and we think we can suggest an improvement, as the lower face can never be tight (see the annexed engraving). The other parts of these engines are so much like the best English practice, that it is needless to pursue the inquiry farther. Th[e s]pace occupied in the [illegible] for each engine is 16 ft. fore and aft, and about [illegible] ft. 9 in. over the main beam.

On the whole, we think the engine[s o]f the *Regent* and *Congress* to highly creditable to Messrs. Ward, Stillman & Co., of New York, by whom they were manufactured, not only as evincin[g] [illegible]able judgment in detail, but more so, in their selection of the co[illegible] engine, which, after all, appears to be the best kind yet produce[d].

[1] Or rather his [illegible] Boulton [illegible] Watt. Mr Watt retired from business in 1800.

THE NEW HOUSES OF PARLIAMENT

THE fifth contract for erecting this national and truly magnificent work has just been entered into, and Messrs. Grissell and Peto are again the successful competitors. This contract or portion of the work is by far the most important that has yet taken place, embracing as it does the Victoria Tower, the Royal Gallery, the Houses of Lords and Commons, with other important and necessary adjuncts thereto. The following particulars have been obtained:—

The Victoria Tower, or Royal entrance, necessarily occupies the first position in the arrangement, whether as regards the order of description or the magnitude of its structure, which perhaps will be one of the richest and most gigantic specimens of Gothic architecture that this or any other country can boast. Beneath this tower the Royal entrance will be formed presenting an area of 60 feet square, into which the Royal and other state carriages will be enabled to drive with the most perfect ease, turn round at the foot of the Royal staircase, and depart at the entrance on the south side. The upper stories of the tower will be used as secure depositories for public records and state documents. The external square of the tower will be 78 feet at the principal floor level, from which point it will be ornamented with the richest specimens of Gothic sculpture to the height of 240 feet, reaching to the base of the four crowned turrets by which it will be surmounted. The entire height, from the bottom of the tower to the top of the turrets, will be 300 feet.

The Royal entrance-hall or vestibule is the next object of interest included in the present contract, and will be approached from the right-hand side of the tower, leading from the principal staircase to the Royal Gallery.

For the Royal Gallery, the next in order, no pains have been spared on the design to render this portion of the edifice of surpassing richness and magnitude. The upper part of the walls will be of the most elaborately-sculptured designs of Gothic ornaments, while the lower portion of the walls is divided into compartments intended for the reception of the most exquisite subjects in fresco painting.

The Royal Robing-room will be next approached from the Royal Gallery, and will strictly harmonize with the fittings and ornaments of the latter. It will be a most splendid apartment, 40 feet in length and 30 feet in width, immediately adjoining the house of Lords, with entrances for the Sovereign on each side of the throne.

The Bishops' Robing-room, a large apartment on the right-hand side of the Robing-room of Her Majesty, will be appropriated to the use of the spiritual peers.

The House of Lords comes next in the order of arrangement, and will be situate on the principal story, preserving a level throughout with the old floor of St. Stephen's Chapel, so that the entrance for the peers may either be obtained along the corridors from the river front, or by that leading from Old Palace-yard. The size of the House of Lords, as well as that of the House of Commons, will be reduced to the smallest possible limits compatible with the required accommodation, and to give them that form and arrangement which will afford the greatest number of sittings in the smallest space, bring the members nearest to each other and to the speaker, and be the most convenient for carrying on the ordinary routine of business.

The two houses will be placed as nearly as possible in the centre of the whole mass of buildings, this being considered the position best adapted for communication with each other, and with their respective offices and accommodations; for easy access from the various entrances and approaches, public and private; for security from noise and disturbance; for allowing their form and size to be exactly fitted to the wants of each house; for the purposes of lighting, warming, and ventilating in the most convenient manner; and for making any modifications or alterations in them which may be thought desirable without deranging the general plan and elevations.

It has been thought proper to avoid placing any members' seats under the galleries, as well as any seats whatever behind the woolsack or the Speaker's chair.

From the House of Lords a spacious lobby and corridor will lead directly to the great centre hall, immediately under the centre tower. This hall will be a large apartment, of a circular form, and 60 feet in diameter, and the principal public approach to the committee-rooms from it will be by a broad flight of steps to a large waiting-room on the first floor, from which there will be a direct and immediate access to the committee rooms of each house, and to the offices connected with them. When the Houses commence their sittings, and the daily business is at an end, the public may retire either by the principal staircase, or by that which leads to Westminster Hall. The central tower will rise in an octangular form, and will be 270 feet in height.

From the central hall, proceeding northward, will be the Commons' corridor and lobby, leading to the House of Commons, with the residence of officers in that division on the east side of New Palace-yard.

Attached to each House of Parliament will be refreshment-rooms and offices, and the approaches of the Sovereign, the members of both houses and the public; the clerks' and other offices are so arranged as to be wholly independent of each other, with the means of making them entirely or partially in communication.

The members and officers attending committees, it is arranged, may go or return by private staircases communicating with their respective houses and offices.

The whole of the official residences will have separate external entrances and staircases; the principal floor of that for the Speaker will be expressly devoted for state levees or Parliamentary dinners, and will be fitted up on a scale of great splendour.

The libraries and committee-rooms of each house are placed towards the river, for the convenience of light, and freedom from noise and disturbance, and the former are so arranged on the principal floor as to be *en suite*, with the power of extending them at pleasure, by including the adjoining committee-rooms.

The ancient chapel of St. Stephen, the crypt, and cloisters are preserved; over the crypt the spacious apartment will form the inner vestibule to the houses of Parliament, to be called St. Stephen's Hall. This hall will be fitted up in the same style of ornament as the Royal Gallery and the corridors, with the introduction of choice subjects in fresco painting.

Another important feature will also be found in the construction of the two houses for the purpose of a complete and thorough ventillation. This department has been placed under the superintendence of Dr. Reid, who, after a variety of trials of different plans and experiments, has adopted a mode of ventilation by which not only the houses of Parliament but every apartment and office connected therewith may, it is said, be regulated at pleasure. It is proposed that the three great towers shall be made available for this purpose, and from a certain height that the masonry of them shall be hollow, and pierced in several places for the reception and egress of air. According to the state of the wind, air might be received from the Victoria or clock towers, which will occupy the northern and southern extremeties. The form of the Victoria Tower has been already described; the clock tower will also be of the square form, finishing spirally, and of the height of 270 feet. The air thus obtained will be forced by machinery through the vaults under the body of the whole edifice, thence it will be discharged by means

of chambers to the body of both houses, extending to the Royal Gallery and the main and entire portions of the buildings. After passing through the various apartments the air will be received by means of perforated ceilings into chambers to be fitted above the roofs, and will be carried off up the central tower.

The works that are already in progress on the eastern or river front are in a great state of forwardness, and will, when completed, extend to 870 feet in length. The ground floor embraces repositories and offices, and the principal one, the Lords' and Commons' libraries, committee-rooms, the conference-hall, and the public and private corridors. The south front will be 340 feet long, that portion next the river being appropriated as the residence of Sir Augustus Clifford, the Usher of the Black Rod. The opposite front, on the northern wing, will comprise the residence of the Speaker of the House of Commons, the Sergeant-at-arms, and other officers.

The external works of the first and principal stories on the river front, including the Lords' and Commons' river entrances, are nearly completed, and the decorations are of the most extensive character. The northern and southern fronts are ornamented with elaborately-sculptured niches in which are placed statues of the various kings who reigned in England prior to the Conquest.

Along the whole eastern front, immediately under the principal floor windows is an ornamented band, on which is displayed in strong relief, in old English characters, the names of every sovereign who has reigned in England since the Conquest, commencing in chronological order with William the Conqueror, and terminating with that of William IV., and above each are the Royal arms of England richly sculptured.—*Standard.*

LAW PROCEEDINGS.

HOARD NUISANCE.

In the Court of Queen's Bench, Friday, December 2nd. (Sittings at Nisi Prius at Westminster, before Mr. Justice Coleridge and a Special Jury.)

MURRAY *v.* TIGAR.

The Solicitor-General, Mr. Platt, and Mr. M. Smith, conducted the case for the plaintiff; and Mr. Thesiger, Mr. Dundas, and Mr. Watson, that of the defendant.

This was an action brought by a gentleman residing at No. 16, George-street, Hanover-square, to recover compensation for the injury which he had sustained by reason of the defendant having erected a "hoard," for which some open boarding had been afterwards substituted.

It appeared that the premises occupied by the plaintiff abutted on those occupied by the defendant, who, in 1839, had erected the hoard in question, for which the open boarding had been substituted, within 10 feet of the dining-room windows of the plaintiff. The object was not to recover damages, but to get rid of the nuisance. The servants who had lived in the plaintiff's family before and after the erection of this obstruction, stated that the light in the lower rooms of the house had been considerably diminished, that the walls had become damp in consequence of the free circulation of air being impeded, and that the provisions in the larder had frequently been spoiled from the same cause. Several architects and surveyors gave it as their opinion that the value of the house was diminished by one-third, and Dr. Ure stated that he had performed several experiments which convinced him that the light in the plaintiff's dining-room had undergone a diminution of six degrees by the erection of the hoard, and three degrees by the open boards. Mr. Facey corroborated Dr. Ure's evidence, and the medical attendant of the family deposed that Mrs. Murray's health had suffered materially in consequence.

Mr. Thesiger contended that the plaintiff had no right to recover for any loss of prospect or comfort, and that the evidence as to the obstruction of light and air was most unsatisfactory.

Mr. Justice Coleridge having summed up,

The Jury found for the plaintiff, with nominal damages.

PROFESSIONAL CHARGES.

In the Court of Queen's Bench, Friday, December 2nd. (Sittings at Nisi Prius at Westminster, before Mr. Justice Coleridge and a Common Jury.)

DOBSON *v.* CROZIER.

Mr. Platt and Mr. C. Clark were counsel for the plaintiff; and Mr. Whateley and Mr. Petersdorff for the defendant.

This was an action to recover £54 5*s.* 6*d.*, for work and labour done by the plaintiff, who is an architect.

It appeared that the plaintiff had drawn up certain plans and specifications for the erection of a house for the defendant, for which tenders had been offered by builders, but which plan had not been carried into effect. He had subsequently drawn other plans and specifications, from which the house had been erected. The defendant had paid £35 into court, being 5 per cent. on the money expended in carrying into execution the accepted plans. The plaintiff claimed in addition £10 for his trouble in drawing the rejected plans, and some other items, making together the sum of £53, for which the action was brought.

Several surveyors were called for the defendant, who stated it was the custom of the profession to charge 2½ per cent for rejected plans, but they disallowed all items but that charge.

For the defendant it was contended that the plaintiff had not proved that the plans had been rejected through the caprice of the defendant, and therefore it must be taken that the plans were inapplicable.

The learned Judge having summed up, the jury returned a verdict for the plaintiff for 9*l.* 10*s.*, in addition to the money paid into court.

BLACKWALL RAILWAY.—INFRINGEMENT OF PATENT.

In the Court of Queen's Bench, Monday, December 19th. Before a Special Jury.

CURTIS *v.* THE DIRECTORS.

This was an action for the alleged infringement of a patent which had been taken out by the plaintiff, for connecting and disconnecting the draught or ground rope of a railway, with railway carriages, when the rope was in motion. The plan was specially applicable to railways where the carriages were drawn, as on the Blackwall Railway, by means of a rope moved by an engine placed at the spot, towards which the carriages were desired to be drawn. The defendants had adopted a plan for effecting this purpose, which it was alleged was essentially the same as that invented by the plaintiff. The defence was, that the plans were not the same, and that that which was in use on the Blackwall Railway had been suggested to the directors some time before the specification of the plaintiff was published. There was a good deal of evidence given as to the practicability of ever attaching a rope to a railway carriage when the rope was in motion, and much doubt was thrown upon the possibility of such a performance; but a person, named Barn, stated that he had twice done it when in the service of the Blackwall Railway Company; once when, in coming up to London, the rope accidentally got detached, and once at the Limehouse station, when no passengers were in the carriage, for the purpose of an experiment. He, however, said, that it required a "good man" to do it, and the appearance of the witness showed that he came within this expression, in the particular meaning he attached to it. Witnesses having been examined on both sides, the cause, which had occupied the whole of the day, was terminated by the jury interfering, and stating that they were of opinion the powers used by the two parties were not the same, when the plaintiff consented to be non-suited.

ROYAL EXCHANGE.

We hope it may not turn out that there was more of hurry than good speed manifested in the competition for the sculpture that is to adorn the pediment of the portico. Quick work it certainly was, when after being sent in on the evening of the preceding day, the designs were "examined"? on the 25th November, and the ballot-box brought into play instanter; the majority of votes being in favour of Mr. Westmacott—whom rumour had previously marked out as *likely* to be the *fortunate* competitor. After so much has been said relative to the manner in which competitions are managed and mismanaged, it might have been thought that at any rate a little more tact and adroitness would have been employed on this occasion. Whether such was really the case or not, it certainly now *looks* as if it had been a preconcerted affair; for hardly is it possible to suppose that the committee could competently judge off-hand of the merits of the designs as works of art—unless indeed the one chosen was so evidently superior to the two others, as to have no room for doubt or question—which is not very probable. We ourselves saw one of the rejected designs, or rather two different designs by Mr. Watson, the artist who has lately given such public proof of his ability in the bas-relief of the new Commercial Hall in Threadneedle Street; and having seen them, we certainly doubt very much at present if the one "*selected*" be—we will not say of greater, but of equal merit. Upon Hamlet's principle of "Assume a virtue, if you have it not," there might have been the appearance of a little deliberation; there might have been an interval of three or four weeks, during which, artists and those known to be judges of art should have been allowed to inspect the designs, and public opinion in regard to them, so far taken, and taken also into consideration. Possibly the one which is to be executed is the best design, and so too, might the best design have been the winner, had the matter been decided by lottery. If it be worth while to bestow so considerable a sum as Three Thousand Guineas or Pounds on the decoration of the pediment, it was surely worth while to bestow far more scrupulous attention upon the design itself, beforehand than now appears to have been done. However, the Gresham Committee have, in this instance, shown themselves to be men of business and dispatch, who can make up their minds very quickly, without any nonsensical "shilly-shallying." Still, with all our misgivings, we are willing to hope for the best; though as poor Mrs. Nickleby says, "we ought never to be over and above *sanguinary* in our expectations!"

THE FINE ARTS.—THE ROYAL ACADEMY.

On Saturday, the 10th ult., there was a very numerous meeting of the members of the Academy, in Trafalgar-square.

Sir Martin Archer Shee was in the chair; and there were present Sir R. Westmacott, Sir W. Ross, A. Cooper, R. Cooke, H. P. Briggs, W. Etty, C. L. Eastlake, P. Hardwicke, D. Maclise, W. Mulready, T. Unwin, W. Wyon, W. Collins, E. Landseer, C. R. Leslie, J. M. W. Turner, C. R. Cockerell, J. J. Chalon, W. T. Witherington, D. Roberts, E. H. Bailey, and A. E. Chalon, members of the Academy.

At nine o'clock the President commenced the business of the evening, by stating the objects the Academy had in view, by giving those annual rewards to the students who gave tangible proofs of talent, vigilance, and application in the various classes of drawing, painting, sculpture, and architecture; and he then went into a detail of the merits displayed in the respective classes, to all of which except that of models from the life subject, the medals were cheerfully given by the Council; and the reason for not giving a medal in that class, arose from there only being one candidate, and therefore there could be no competition. The merits of the chalk drawings made from the living models, and from the antique statues, were mentioned in terms of high commendation by the President, who observed emphatically, that the style of drawing these difficult objects had considerably improved within the last two or three years, which he stated arose from the alterations made, deviating from the late method, and which had been judiciously made by the present keeper of the Academy. To the copies in oil from Guido's picture of "Fortune," the President gave high and deserved commendation, as well as to the architectural plans, elevations, and sections of the beautiful Church of Walbrook.

The prizes were then distributed in the following order, viz. —

To Mr. James Clarke Hook, for the best copy made in the school of painting, the silver medal, with the lectures of the Professors Barry, Opie, and Fuseli.

To Mr. Alfred Rankley, for the next best copy made in the painting school, the silver medal.

To Mr. J. C. Hook, for the best drawing from the living models, the silver medal.

To Mr. John Clayton, for the best drawings of the ground plan, sections, &c., of St. Stephen's Church, Walbrook, the silver medal.

To Mr. James Harwood, for the best drawings from the antique, the silver medal.

To Mr. Alfred Gatley, for the best model from an antique statue, the silver medal.

After the delivery of the prizes, the President concluded the public business of the evening with an address from the chair, which was replete with the soundest practical observations upon the state, condition, and prospects of the arts in this country. We regret that our limits do not allow us to give a full report of this able and eloquent discourse; but amongst the points he touched upon with energy and feeling were, that unworthy and groundless prejudice that still remains in the minds of a few of the noble and wealthy classes in England, which would place foreign modern arts far above that of Great Britain, even at the present day. This morbid desire to set up every country above their own in matters of an intellectual nature, was far more commonly entertained some years since in England than it has been of late; we have done our part in demolishing this unnatural, this monstrous doctrine, and it has been damaged irretrievably. After the President had clearly and with much energy pointed out the gross absurdities and contradictions of the few anti-national connoisseurs who still exist, he properly noticed another unnatural practice which militates against the arts of the United Kingdom—namely, the vituperation poured forth *pleno flumine* by the minor press, generally, against the native artists and their works. The President went into many topics professionally interesting, and, on concluding his address, was warmly applauded.

The general assembly then proceeded to appoint officers for the ensuing year, when Sir Martin Archer Shee was unanimously elected President.

Council, New List.—Messrs. Charles Barry, George Jones, Alfred E. Chalon, and Thomas Phillips.

Old List.—Messrs. Philip Hardwick, David Roberts, John James Chalon, and William Mulready.

Visitors in the Living Model Academy, New List.—Messrs Edward H. Bailey, Alfred E. Chalon, Richard Cook, and William Frederick Witherington.

Old List.—Messrs. Charles Robert Leslie, William Mulready, Thomas Uwins, and W. Wyon.

Visitors in the School of Painting, New List.—Messrs. Henry P. Briggs, Charles L. Eastlake, Charles Robert Leslie, and Thomas Uwins.

Old List.—Messrs. W. Collins, W. Etty, Edwin Landseer, and David Roberts.

Auditors re-elected.—Messrs. William Mulready and J. M. W. Turner, and Sir R. Westmacott.

THERMOGRAPHY.

Art of Copying Engravings, or any Printed Characters from Paper on Metal Plates; and on the Recent Discovery of Moser, relative to the Formation of Images in the Dark. By MR. ROBERT HUNT. *Read at the Meeting of the Cornwall Polytechnic Society, on the 8th Nov. of which excellent Society Mr. Hunt is the secretary.*

THE Journal of the Academy of Sciences of Paris, for the 18th of July, 1842, contains a communication made by M. Regnault, from M. Moser, of Konigsberg, "Sur la formation des images Daguerriennes;" in which he announces the fact, that "*when two bodies are sufficiently near, they impress their images upon each other.*" The Journal of the 29th of August contains a second communication from M. Moser, in which the results of his researches are summed up in 26 paragraphs. From these I select the following, which alone are to be considered on the present occasion:—"All bodies radiate light, even in complete darkness.—This light does not appear to be allied to phosphorescence, for there is no difference perceived whether the bodies have been long in the dark, or whether they have been just exposed to daylight, or even to direct solar light.—Two bodies constantly impress their images on each other, even in complete darkness. However, for the image to be appreciable, it is necessary, because of the divergence of the rays, that the distance of the bodies should not be very considerable.—To render the image visible, the vapour of water, mercury, iodine, &c. may be used.—There exists *latent light* as well as latent heat."

The announcement at the last meeting of the British Association of these discoveries, naturally excited a more than ordinary degree of interest. A discovery of this kind, changing, as it does, the features, not only of the theories of light adopted by philosophers, but also the commonly received opinions of mankind, was more calculated to awaken attention than anything which has been brought before the public since the publication of Daguerre's beautiful photographic process. Having instituted a series of experiments, the results of which appear to prove that these phenomena are not produced by *latent light*, I am desirous of recording them.

I would not be understood as denying the absorption of light by bodies; of this I think we have abundant proof, and it is a matter well deserving attention. If we pluck a Nasturtium when the sun is shining brightly on the flower, and carry it into a dark room, we shall still be enabled to see it by the light which it emits. The human hand will sometimes exhibit the same phenomenon, and many other instances might be adduced in proof of the absorption of light; and I believe, indeed, of the principle that light is latent in bodies. I have only to show that the conclusions of M. Moser have been formed somewhat hastily, being led, no doubt, by the striking similarity which exists between the effects produced on the Daguerreotype plates under the influence of light, and by the juxtaposition of bodies in the dark, to consider them as the work of the same element.

1. Dr. Draper, in the Philosophical Magazine for September 1840, mentions a fact which has been long known, that "if a piece of very *cold* clear glass, or what is better, a *cold* polished metallic reflector, has a little object, such as a piece of metal, laid on it, and the surface be breathed over once, the object being then carefully removed, as often as you breathe again on the surface, a spectral figure of it may be seen, and this singular phenomenon may be exhibited for many days after the first trial is made." Several other similar experiments are mentioned, all of them going to show that some mysterious molecular change has taken place on the metallic surface, which occasions it to condense vapours unequally.

2. On repeating this simple experiment, I find that it is necessary for the production of a good effect, to use dissimilar metals; for instance, a piece of gold or platina on a plate of copper or of silver, will make a very decided image, whereas, copper or silver on their respective plates give but a very faint one, and bodies which are bad conductors of heat placed on good conductors, make decidedly the strongest impressions when thus treated.

3. I placed upon a well polished copper plate, a sovereign, a shilling, a large silver medal, and a penny. The plate was gently warmed by passing a spirit lamp along its under surface: when cold, the plate was exposed to the vapour of mercury; each piece had made its impression, but those made by the gold and the large medal were most distinct; not only was the disc marked, but the lettering on each was copied.

4. A bronze medal was supported upon slips of wood, placed on the copper, one-eighth of an inch above the plate. After mercurialization, the space the medal covered was well marked, and for a considerable distance around the mercury was unequally deposited, giving a shaded border to the image.

5. The above coins and medals were all placed on the plate, and it was made too hot to be handled, and allowed to cool without their being removed: impressions were made on the plate in the following order of intensity, gold, silver, bronze, copper. The mass of the metal was found to influence materially the result; a large piece of copper making a better image than a small piece of silver. When this plate was exposed to vapour, the

results were as before (3, 4). On rubbing off the vapour, it was found that the gold and silver had made permanent impressions on the copper.

6. The above being repeated with a still greater heat, the image of the copper coin was, as well as the others, most faithfully given, but the gold lead, and silver only made permanent impressions.

7. A *silvered* copper plate was now tried with a moderate warmth (3). Mercurial vapour brought out good images of the gold and copper; the silver marked, but not well defined.

8. Having repeated the above experiments many times with the same results, I was desirous of ascertaining if electricity had any similar effect: powerful discharges were passed through and over the plate and discs, and it was subjected to a long continued current without any effect. The silver had been cleaned off from the plate (7), it was now warmed with the coins and medals upon it, and submitted to discharges from a very large Leyden jar; on exposing it to mercurial vapour, the impressions were very prettily brought out, and strange to say, spectral images of those which had been received on the plate when it was silvered (7). Thus proving that the influence, whatever it may be, was exerted to some depth in the metal.

9. I placed upon a plate of copper, blue, red, and orange coloured glasses, pieces of crown and flint glass, mica, and a square of tracing paper. These were allowed to remain in contact half an hour. The space occupied by the red glass was well marked, that covered by the orange was less distinct, but the blue glass left no impression. the shapes of the flint and crown glass were well made out, and a remarkably strong impression where the crown glass rested on the tracing paper, but the mica had not made any impression.

10. The last experiment repeated; after the exposure to mercurial vapour, heat was again applied to dissipate it, the impression still remained.

11. The experiment repeated, but the vapour of iodine used instead of that of mercury. The impressions of the glasses appeared in the same order as before, but also a very beautiful image of the mica was developed, and the paper well marked out, showing some relation to exist between the substances used and the vapours applied.

12. Placed the glasses used above (9, &c.), with a piece of well smoked glass, for half an hour one-twelfth of an inch below a polished plate of copper. The vapour of mercury brought out the image of the smoked glass only.

13. All these glasses were placed on the copper, and slightly warmed; red and smoked glasses gave, after vaporization, equally distinct images, the orange the next, the others left but faint marks of their forms: polishing with tripoli and putty powder would not remove the images of the smoked and red glasses.

14. An etching, made upon a smoked etching ground on glass, the copper and glass being placed in contact. The image of the glass only could be brought out.

15. A design cut out in paper was pressed close to a copper plate by a piece of glass, and then exposed to a gentle heat; the impression was brought out by the vapour of mercury in beautiful distinctness. On endeavouring to rub off the vapour, it was found that all those parts which the paper covered amalgamated with mercury, which was removed from the rest of the plates: hence there resulted a perfectly permanent white picture on a polished copper plate.

16. The coloured glasses before named (9. 12), were placed on a plate of copper, with a thick piece of charcoal, a copper coin, the mica, and the paper, and exposed to fervent sunshine. Mercurial vapour brought up the images in the following order—smoked glass, crown glass, red glass, mica beautifully delineated, orange glass, paper, charcoal, the coin, blue glass; thus distinctly proving, that the only rays which had any influence on the metal, were the calorific rays. This experiment was repeated on different metals, and with various materials, the plate being exposed to steam, mercury, and iodine; I invariably found, that those bodies which absorbed or permitted the permeation of the most heat, gave the best images. The blue and violet rays could not be detected to leave any evidence of action, and as spectra imprinted on photographic papers by light which had permeated these glasses, gave evidence of the large quantity of the invisible rays which passed them freely, we may also consider those as entirely without the power of effecting any change on compact simple bodies.

17. In a paper which I published in the *Philosophical Magazine* for October, 1840, I mentioned some instances in which I had copied printed pages and engravings on iodized paper, b mere contact and exposure to the influence of the calorific rays, or to artificial heat. I then, speculating on the probability of our being enabled, by some such process as the one I then named, to copy pictures and the like, proposed the name of Thermography, to distinguish it from Photography.

18. I now tried the effects of a print in close contact with a well-polished copper plate. When exposed to mercury, I found that the outline was very faithfully copied on the metal.

19. A paper ornament was pressed between two plates of glass, and warmed, the impression was brought out with tolerable distinctness on the under and warmest glass, but scarcely traceable on the other.

20. Rose leaves were faithfully copied on a piece of tin plate, exposed to the full influence of sunshine, but a much better impression was obtained by a prolonged exposure in the dark.

21. With a view of ascertaining the distance at which bodies might be copied, I placed upon a plate of polished copper, a thick piece of plate glass, over this a square of metal, and several other things, each being larger than the body beneath. These were all covered by a deal box, which was more than half an inch distant from the plate. Things were left in this position for a n ght. On exposing to the vapour of mercury, it was found that each article was copied, the bottom of the deal box more faithfully than any of the others, the grain of the wood being imaged on the plate.

22. Having found, by a series of experiments, that a blackened paper made a stronger image than a white one, I very anxiously tried to effect the copying of a printed page or a print. I was partially successful on several metals, but it was not until I used copper plates amalgamated on one surface, and the mercury brought to a very high polish, that I produced any thing of good promise. By carefully preparing the amalgamated surface of the copper, I was at length enabled to copy from paper line-engravings, wood-cuts, and lithographs, with surprising accuracy. The first specimens produced (which were submitted to inspection), exhibit a minuteness of detail and sharpness of outline quite equal to the early Daguerreotypes and the photographic copies, prepared with chloride of silver.[1]

The following is the process at present adopted by me, which I consider far from perfect, but which affords us very delicate images. A well polished plate of copper is rubbed over with the nitrate of mercury, and then well washed to remove any nitrate of copper which may be formed; when quite dry, a little mercury taken up on soft leather or linen is well rubbed over it, and the surface worked to a perfect mirror. The sheet to be copied is placed smoothly over the mercurial surface, and a sheet or two of soft, clean paper being placed upon it, is pressed into equal contact with the metal by a piece of glass, or flat board; in this state it is allowed to remain for an hour or two. The time may be considerably shortened by applying a very gentle heat for a few minutes to the under surface of the plate. The heat must on no account be so great as to volatilize the mercury. The next process is to place the plate of metal in a closed box, prepared for generating the vapour of mercury. The vapour is to be slowly evolved, and in a few seconds the picture will begin to appear; the vapour of mercury attacks those parts which correspond to the white parts of the printed page or engraving, and gives a very faithful but somewhat indistinct image. The plate is now removed from the mercurial box, and placed in one containing iodine, to the vapour of which it is exposed for a short time; it will soon be very evident that the iodine vapour attacks those parts which are free from mercurial vapour, blackening them. Hence there results a perfectly black picture, contrasted with the grey ground formed by the mercurial vapour. The picture being formed by the vapours of mercury and iodine, is of course in the same state as a Daguerréotype picture, and is readily destroyed by rubbing. From the depth to which I find the impression made into the metal, I confidently hope to be enabled to give to these singular and beautiful productions a considerable degree of permanence, so that they may be used by engravers for working on. It is a curious fact, that the vapours of mercury and of iodine attack the plate differently, and I believe it will be found that vapours have some distinct relation to the chemical or thermo-electrical state of the bodies upon which they are received. Moser has observed this, and attributes the phenomena to the colours of the rays, which he supposes to become latent in the vapour on its passing from the solid into the more subtile form. I do not, however, think this explanation will agree with the results of experiments. I feel convinced that we have to deal with some thermic influence, and that it will eventually be found that some purely calorific excitement produces a molecular change, or that a thermo-electric action is induced, which effects some change in the polarities of the ultimate atoms of the solid.

These are matters which can only be decided by a series of well conducted experiments. Although attention was called to the singular manner in which vapours disposed themselves on plates of glass and copper, two years since by Dr. Draper, Professor of Chemistry at New York, and about the same time to the calorific powers of the solar spectrum, by Sir John Herschel, and to the influence of heat artificially applied, by myself (17), yet it is certainly due to M. Moser of Konigsberg, to acknowledge him to be the first who has forcibly called the attention of the scientific world to an inquiry which promises to be as important in its results as the discovery of the electric pile, by Volta.

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[1] The first faithful copy of the lines of a copper plate engraving was obtained by Mr Cantabrana, who has since succeeded in procuring some tolerable specimens on amalgamated copper which cannot be rubbed off.

NOTES ON EARTH WORK, EXCAVATION, CUTTING, AND FORMING EMBANKMENT UPON RAILWAYS.

ARTICLE IV.—SUPERINTENDENCE, ACCOUNTS, AND MEASUREMENTS.

"Modern practice has reduced it to a price per cube yard."
Professor Vignoles's Lecture, Dec. 1841.

IN pursuance of my promise given at the conclusion of my former paper, I shall now attempt to give a description of the methods in use during the execution of railways, as regards the supervision, both on the part of the Company and contractor. First, then, as to the engineering staff; we have parliamentary and consulting engineers, engineer in chief, resident, assistant, and sub-engineers, but the duties of the resident and assistant it will only be necessary for me to notice. The resident controls the whole line and the assistants, and confers with the Directors at all their meetings for finance, and when the line exceeds 50 miles in length, the duties will be so multiplied that two will be requisite. The assistants are subordinate to the resident, and have generally a division of 10 miles each, or perhaps a length of, say three contracts. The duties of an assistant is to observe that the works are executed according to plan, and that the materials are of proper quality, and if not so, to complain, first to the contractor, and if not attended to, then to the resident: to allow no change to be made in the dimensions without the sanction of the resident, and if any change is ordered, to ascertain the difference for or against the contractor jointly with him or his agent, to enter these measurements in a book, and to make a return monthly to the resident, as also of all materials received on the Company's account, as rails, chairs, keys, sleepers, blocks, &c. He is also to make a return each fortnight, of the number of men employed by the contractor, to measure works for monthly payments, and price them by the schedule attached to the contract. In taking the measurements, he will much facilitate his work by making them as near as possible to given points, so as to save re-measurements. He is also to see that all levels are executed with reference to bench marks and documents given, and to preserve the centre or trig lines, especially in curves, and to give the half width of railway, and to see that no more land is enclosed than has been purchased, and finally to be in frequent communication with the resident, and if any thing unexpectedly occurs, to lose no time in communicating it. From the above statement of duties, it will be seen that great responsibility is often placed on the shoulders of the assistant, partly owing to the distance that separates him from the resident.

The accounts in detail are in the province of the contractor, which will be hereafter considered. The assistant should have a knowledge of measuring land and artificer's work, as at the stations on the line he is brought into communication with slaters, joiners, masons, plumbers, &c. The supervision of a contract on the part of a contractor will consist of a superintendent, clerk, timekeepers, and foreman over each department of artificers. The superintendent sets out the works, and sub-lets them to the various gangers and butty gangs, and measures and prices their work; he also measures with the assistant engineer for the monthly payments. The clerk keeps the books, &c. and invoices. The foremen superintend their own trade, and examine the goods sent to the works, with the invoice, both as regard quality and quantity: they also send in a weekly return of all the men's time individually, and the nature of his employment, whether on extra or contract work, and any materials sent to other works, each individual workman making a return to him on a printed form provided for the purpose. The timekeepers collect the names of the ganger's men employed at occasional daywork, and count the number of men in each gang four times daily, and take an average as to the number employed for the day. One day is retained in hand from each man employed at daywork, until he is discharged, the wages being paid on the Saturday although not for that day, but the Saturday preceding, counting from each Friday night.

I will, perhaps, better explain myself by giving, as it were, instructions to a set of men on a contract as to the manner they should adopt in keeping the accounts:—then as to the clerk, he is to debit the ganger's account, with the weekly men received, and enter to his credit the quantities and prices he is to have for his work; to fill up a weekly summary, showing how many men have been employed upon each separate description of work, and to render a perfectly separate account of day work. With respect to payments, he is to pay no task man without express sanction of superintendent, and to pay no day man except on a Saturday, unless he discharge himself entirely from the works, when he is to pay the back day kept in hand. He is to receive the invoices after they are examined by the foreman, whose duty it is to receive the goods. The invoices to be filed until the monthly or quarterly bills are delivered for examination. The invoices are to be copied into the day book, materials sent to or received from other works to be entered in books expressly for that purpose, bricks, lime and sand will be kept in separate accounts, backed with the party's name who supplies each material. No goods to be sent by tradesmen without an order, and to have a return ticket on delivery, for both of which forms are provided. Timekeepers to deliver to the desk every evening, the correct time and name of every man employed at daywork; also daily, the name of every ganger, the number of men, where at work, and the description of work. Any claim by the ganger for daywork not to be allowed unless rendered to the office as the regular daymen, and he must apply for payment the next Saturday, as it will not be paid at a subsequent period; and his account for taskwork must be settled monthly.

The superintendent lets and measures the works, and is responsible for the levels, and he is in fact the whole executive, the contractor being the capitalist or speculator. In the preceding account, no notice is taken of truck system, tommy shops, menage shops, or subsist money, or any of the tricks of contractors without capital, or such as those would be sure to have the lowest estimate; but the proceedings of a wealthy and reputable contractor are recorded, and from having seen service in both camps, I can bear testimony as to the good effects, both morally and physically, of the latter method of proceeding. The facility now given to contractors of keeping accounts open for an indefinite time, would be much checked, if engineers would not certify contracts completed, until the contractors previously lodged with them copies of all their extra claims.

With respect to measurement of works in progress, the various tables published by M'Neil, Day, Bidder, and the prismoidal formula, &c., are perfectly inapplicable, from the broken nature of the ground, it assuming shapes so various and uncouth at the different benches, gullets and levels: it is, therefore, necessary to take the dimensions on the ground, and by computation, ascertain the cubic contents. A considerable difference of opinion exists as to the modes of so doing, some using the decimal, and others the duodecimal measures; the former gives the contents in yards by multiplication, and the latter gives greater facility for the application of practice, or the division by aliquot parts; and the total can easily be converted into yards by dividing the number of cubic feet in a yard. In the one case, all dimensions are taken in feet and inches, and in the other, they are taken by a yard and decimal parts, the yard being divided decimally into a hundred divisions: this latter method is most used by old practitioners but feet and inches are now being more used than formerly. The dimensions are recorded in two columns; one for the length, breadth, and depth, placed one over the other always in the same succession, the other column being left for the cubic contents of each dimension as it is squared, so as to make the addition of the several items into a total more easy. The dimensions of finished cuttings are taken at each chain's length, by a line stretched across on the natural surface of the ground, and a staff held in the centre, by an assistant, and a mean of the two ends taken for the depth. The width is measured half way up each slope in the centre of each chain. The length is measured along the centre of the cutting. The dimensions of each hole in broken work is taken similarly, but is recorded as only on account, and at a subsequent measurement it is retaken from a certain fixed point or chain in the section, which the measurement book will tell if kept on a uniform plan.

In making the monthly return of work executed, all previous measurements are annulled in toto; and the return made is the total quantity done, and not that that is done between each measurement. When a work is very rugged, it is usual to take the measurement of the embankment, and not the cutting, on account of the fewer dimensions. The cuttings are measured generally every fortnight, the intervening time being subsist weeks, when the pay is on account, from the timekeeper's return; and in some cases the number of wagons are computed as a check. The persons who act as timekeepers, are generally of the class that has seen better days; the excavators are a migratory horde, they are a collection of the agricultural labourers, who are more spirited than their fellow-countrymen, and who have left their native locality to better their condition; so that in works of this sort, trusting too much to the honour of such men will not do; and the more checks there are the better, or one stands the chance of knowing experimentally the meaning of the term "sloping," which by this time is fully known in France.

I have said nothing as to the mode in which the directors, engineer, and secretary, keep a check on each other; I think, however, that it is done by a system of sub-committees of finance, and the division of the line into districts, and that no monies are paid by the banker without the signatures of three of the directors and the secretary; being on an analogous plan to that adopted in olden times by corpo-

rate bodies—"The wardens each to have a key and a chest with three locks, and each to keep a key." I hope some one who has had a seat at the board will supply the information, as also the form of each printed paper used in each department—say engineer's department, printed forms for return of number of men, specification of rails, and general specification for works, number of yards done on each contract, return for each subdivision of the line, and schedule of prices, and tickets of return for materials received, and letter heads. In superintendent of line, a pass book for free riding on the service of the company, memorandum of coaching department, code of signals, instructions and duties of guards, general regulations for police, superintendent, inspectors, constables, switchmen and gatekeepers; instructions for the use of signal flags. Police department, return of train before or after time, number of engine, name of driver, number and description of carriages, trucks, wagons, horse boxes, and inspectors' remarks, and occurrences at the different stations, viz., number of coaches of 1st, 2nd, or 3rd class, and carriage trucks, vans, wagons, and mails leaving each station and left behind; also, a return of the name of upper guard, whether delayed by passengers or water, with the time of arrival, when due and despatched from each station. There are also a return of absentees, whose wages are suspended, viz., number of column, name, quality, where stationed, and cause of absence, and amount of wages. In addition to the above related departments, there are the printed time tables, and the ticket system; of colours for the different classes, and whether going east, west, north, to notice the returns or accounts rendered by police, when a line is south, or on the up or down trains.

In conclusion, the mention of defalcations must not be omitted that have taken place in the staff of the companies, which have amounted to upwards of six cases, and those invariably in the secretary's department; and in no one case am I aware that they have been brought to trial. The engineers generally come in for the greatest share of odium when works are unsuccessful, but I think the blame ought to be divided between the solicitor, secretary, and other officers, or the committee, which is indefinite enough. The engineer is of necessity obliged to be somewhat acquainted with his business, as influence and patronage will not so exclusively prevail as in other departments. I have known a line of railway where a quondam director slid into the office of superintendent, with £500 a-year; he was originally a druggist, having a seat at the board, which the sub-engineer had not; he was enabled to coerce him to do his duty, with no extra pay, he was a fluent speaker, and often saved the directors from attack; he could not, however, retain his ground, and both he and the body of directors acted shabbily to their employees, and illegally to their employers, the unfortunate shareholders. I may go on for some time longer, but am afraid of the editorial pruning hook; so for the present, conclude.

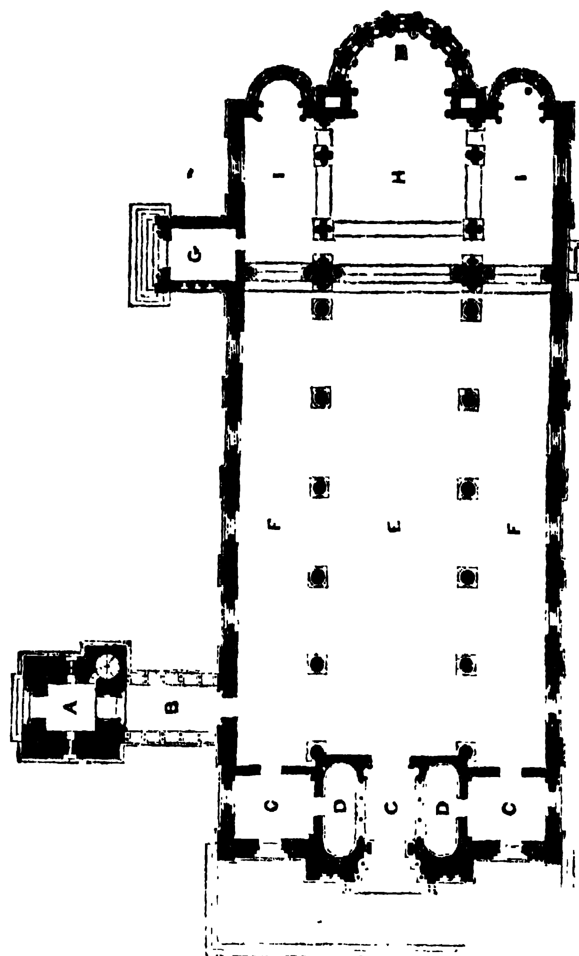
St. Ann's, Newcastle-on-Tyne. O. T.

REVIEWS.

COMPANION TO THE ALMANAC, FOR 1843.

On returning to this publication, we might dispense with prefatory remark; nevertheless, we have one to make by way of suggestion to its publishers, viz., that as they must now afford materials enough for the purpose, were all the architectural chapters from the commencement of the series collected together and reprinted, with such alterations and additions as might be found requisite, they would form a very useful and convenient volume—one that would to a certain extent serve as a Pocket Companion and Architectural Guide to the Tourist. As a sequence to this suggestion, we will venture another to publishers abroad, which is, that an "*Annuaire*" of new buildings, &c., for France and Germany—one for each country—is a desideratum.

Messrs. Wyatt and Brandon here make their début in the "Companion," with some éclat; there being three different buildings by them, and one of them very superior for a building of the kind, although—perhaps it would be nearer the truth to say *because*—it is in that picturesque style the Lombardic, against which, however, the Camden Society folks object, because, forsooth, it is not sufficiently "Christian" for their strait laced notions, upon matters that are purely conventional, and have nothing whatever to do with genuine religion. To object—otherwise than as taste is concerned, against the abandonment of the usages observed by our Roman Catholic builders, is surely ultra-squeamishness, after we have abandoned Romanism itself, with its idle pomposity and all its trumpery. Puseyism and Camdenism seem to have of late completely turned some people's brains. Instead of entering into frivolous, hair-splitting objections, we are well content with Wilton Church, on its own architectural merits, which are no ordinary ones; for while the exterior is strikingly picturesque in composition and design, the interior will, when completed, be quite a model of its kind—simple, yet beautiful and varied in its plan, and tasteful in its decorations; and not only with much to produce effect, but with nothing to counteract it, for there will be no galleries—at least no side galleries—which always give a sort of play-house look to a church; and which, even if capable of being so treated, never are made architectural in appearance, but always so as to cut up and encumber. Still, it must be confessed, that galleries accord very well with Professor Hosking's principle, that in churches "the largest number of persons must be brought within the smallest space!"—it is a wonder he did not add, "and at the cheapest rate." The three apses at the altar end of Wilton Church will be filled with stained glass, and for the further decoration of those recesses, which contribute so much to effect, it is in contemplation to paint their ceilings or semi-domes in fresco, but whether with subjects, or merely ornamental compositions as in the Temple Church, is not stated. Even the strait-laced "Ecclesiologist," though it protests against "the introduction of a foreign style in church architecture," as an evil that ought to be put a stop to at once, allows that Wilton Church is at least "good of its sort." Almost the only other church with regard to which the Companion enters into description, is the one now building by Mr. Poynter, in Broadway, Westminster, in the style of the later period of early English. Its internal dimensions are about 95 by 51 feet, exclusive of a spacious apsis at the east end; but as there are, unfortunately, to be galleries, we fear we must not anticipate any great excellence of architectural



Ground Plan of Wilton Church.

References.—A. Campanile. 17 feet square. 100 high, or extreme height about 120. B. Cloister. C C C. Entrances. D D. Staircases to Children's Gallery. E. Nave, 72 by 24 feet and 54 high. F F. Aisles. G. Vestry. H. Chancel. I I. Aisles to ditto. Extreme length externally, 156 feet; internally, 127. Breadth, internally, [illegible] feet

character. The tower and spire, however, rising together to the height of 200 feet, and placed campanile fashion at the north-west angle of the front, will be a very good and bold feature in the exterior. Of Mr. Pugin's Catholic Church, near the Blind School, no further mention is made, but we suppose that when completed, it will be fully described, and at present it certainly promises well—for there is much excellent detail in doors and windows, some of which will b rather highly decorated, although the general material is only brick—but homely as it is, even that is better than what has been not unaptly called the "stone and starvation" style.

The Wesleyans seem to be patronizing architecture; their College or "Theological Institution" at Richmond, is an extensive stone structure in the Tudor style, and with some novelty in its design; but the wood-cut view of it does not show it to any great advantage, the shadowed parts being indistinct and confused. Whether the execution be as satisfactory as the design, we pretend not to say; but as far as the general character of its façade goes, it appears to be a building that would not disgrace either of our universities. Mr. Cockerell's Sun Assurance Office is spoken of, upon the whole, with commendation, yet not without some exceptions being made to it. The first floor windows are objected to as being rather poor and trivial in design, and as requiring further enrichment which might have been so applied as to fill up the plain spaces or panels between the rusticated piers in which they are set. Had this been done, they would certainly have been more important features in the composition, but not at all more so than their situation requires; and they would at the same time have given greater originality of character to the whole. The *ensemble*, too, would have been more in keeping. The interior of the new libraries at Cambridge—that is, of the north wing, the only portion as yet finished—another work by the same architect, is also described as being greatly better than the exterior, and the principal room is said to be a very noble apartment. Another building at Cambridge, and of which a tolerably full account is here given—which is certainly not the case in Le Keux's Memorials of Cambridge, there being there scarcely a syllable relative to it—is that for the new county courts, by Messrs. Wyatt and Brandon. The façade consists of an Italian Doric order in pilasters, comprising a lesser one of insulated columns from which spring arches, after the manner of a Venetian window. Of these the five centre ones are open so as to form a recessed loggia or arcade, and produce a bold effect of light and shade. The idea is borrowed from Palladio's Basilica at Vicenza, but also exhibits, as is here remarked, a considerable degree of improvement upon the original; though, to talk of improving upon anything by Palladio, that may seem little less than treason to those who hold his works to be the *ne plus ultra* of refined taste. Of the "Brunswick Buildings" at Liverpool, some account was given in our last volume, at page 278, therefore we need here say no more than that the view in the Companion fully bears out the description of it, and shows it to be an exceedingly handsome piece of architecture.

Under the head of "Railways of Great Britain" we have a brief record of the progress of railways since Nov. 1, 1841, by which it appears that, from that time to the present, there is a total extent of 176¼ miles more brought into operation.

An Encyclopædia of Architecture, Historical, Theoretical, and Practical. By Joseph Gwilt. Illustrated by more than 1000 engravings on wood. In one thick volume, 8vo, 1089 pp. London, 1842. Longman & Co.

As one of a series of similar works devoted to separate branches of study, and which has been stamped by public favour, and as a useful and economic compendium for the student, this Encyclopædia will, no doubt, prove a successful publication. Its contents, however, are so multifarious, some of them bearing upon matters which are but very remotely connected with architecture properly so termed, that it is to this last department we must confine ourselves for the present. And we begin by remarking that one great disadvantage attending works of the kind is that, however satisfactorily they are executed, as regards their main purpose, namely, the instructing those who have yet to learn, they are apt to disappoint those who are already familiar with the subject treated of, and of course acquainted beforehand with the substance of the information thus collected together. Allowance must, therefore, be made for want of novelty, since the whole ground must be gone over again, and novelty can be displayed only in the writer's views and opinions, and in his corrections of or additions to what has previously been said by others. We must, accordingly, restrict our observations to the architectural portion of the work, but to those opinions thrown out in it, which come immediately from Mr. Gwilt as their author; for it is these alone that can be made to serve as characteristic specimens, in a mere notice like the present, of so extensive a work.

One thing which is clearly enough apparent is, that Mr. Gwilt has not written *ad captandum*, at least not as far as the profession are concerned, for he expresses himself more than once by no means very encouragingly in regard to the present state of the art in this country, especially as compared with what it is in France. We do not quarrel with him for uttering such opinion, unpleasant as it may be, provided it be uttered in sincerity; but it is to be regretted that, as he has not scrupled to make so severe an allegation, he did not also allege some of the grounds on which it is formed. Possibly he may mean, not that there is greater architectural talent in France, but that greater and more frequent opportunities are afforded it in that country than in our own, where, according to him, it is rather checked than encouraged by the government;—which qualification would have softened the asperity of the censure. Very far be it from us to object to the expression of censure, for it is that which gives value to praise, and which produces improvement by holding up faults for correction; still we do not exactly approve of that species of it which deals in such vague generalities that it is hardly possible to meet and combat it. We own that too many opportunities are made mere jobs of in this country—that interest and favouritism too frequently supersede merit, and that false economy, which often turns out in the end to be very expensive, sadly maims many of our public undertakings in architecture; but we are also of opinion that there is talent among us that would fully vindicate our national reputation in art, were it but drawn out, or rather permitted to display itself uncramped, or even with some tolerable degree of freedom. When we look at what has been done in various parts of the country within the last few years, we perceive, upon the whole, improvement—certainly no falling off, and with regard to ability in Gothic architecture, we stand very far superior to any of our continental neighbours.

We do not dissent, however, very much from Mr. Gwilt, when he tells us that "the splendour of the government offices in this country, seems to be in an inverse ratio from the renown of the department;" in instance of which he refers us to the Admiralty and the "Treasury jumble of buildings;" to which he might have added the Custom House—a most miserable affair in point of architecture, and also the Mint, which has no merit, certainly not that of character, to recommend it. It is notorious that his opinion of the National Gallery is the reverse of favourable, as is likewise that which he entertains of the London University; nor do we suppose that he thinks very highly of either the Post-office, or the British Museum, for though he has not expressly censured, neither has he expressly excepted them from the rest. But it is rather, we trust, with reference to the past than to the immediate present, that there is or henceforth will be room for complaining of the indifference betrayed on the part of the government and those in power, towards architecture and the other fine arts. Something like a public voice in their behalf has lately made itself heard amidst all the never-ceasing din and squabbling of politics, and the daily palavering of the public press. The erection of such a noble fabric as the new Houses of Parliament will at least wipe off some of the reproach justly incurred by many other structures, national in their purposes, though of the nation most unworthy; and it may further be anticipated, that the schemes in contemplation for its internal embellishment, will give a powerful and lasting impulse to other branches of art. We will not risk our credit by predictions that may possibly be falsified by the event: fresco-painting may not succeed here, as far as by success is meant the satisfying public expectation and public taste: but it is a good augury, *ad interim*, that any discussion on the subject of it should have been treated as matter of public interest.

There is no difficulty in interpreting Mr. Gwilt's "expressive silence" in regard to Buckingham Palace, in the section devoted to that class of buildings, more especially as he is exceedingly chary indeed of any thing like praise towards another structure, which some have thought they could not extol too magniloquently. "We regret," he says, "that in this country we can offer no model of a palace for the student. Windsor Castle, with all its beauties, which, however, consist more in site and scenery than in the disposition of a palace, will not assist us." Ungracious and captious as this opinion may appear to many, it does not at all shock us. What we object to is, not the opinion itself, but to the *ipse dixit* tone in which it is uttered, without explanation on the part of the writer, so that we are at a loss to know what it is he most objects to in it; whether it be the plan and arrangement chiefly, or the style and the design.[1] We almost suspect

[1] As neither Mr. Poynter nor Mr. Britton has attempted to enter into a critical examination of the edifice, as it came from Sir Jeffrey's hands—

that it is to these last he objects, and that he is disposed to class Sir Jeffry Wyatville with another "incompetent architect," for he has omitted his name as well as that of Wilkins in his list of architects, as he has likewise that of James Wyatt; which omissions cannot have been other than intentional, and are therefore peculiarly significant. However lightly we may now estimate him, James Wyatt is most indisputably an historic name in the annals of English architecture, and very far less of a mere shadow and *nominis umbra*, than some of those who are registered and catalogued by the historiographers of art, and of whom there is very little more than their dates to record. The name of Schinkel ought to have been inserted, unless the list was actually printed before his death was known in this country, which as it comes nearly at the end of the volume, we can hardly suppose to have been the case. We are aware that Schinkel is no favourite of Mr. Gwilt's; but favourite or not, his fame has spread throughout Europe; and if names so distinguished are to be omitted at pleasure, we may perhaps, ere long, see that of Palladio expunged from a table of eminent architects.[2] At any rate the precedent is an unfortunate one.

It cannot be expected that we should pretend to go regularly through a work so comprehensive, or have as yet thoroughly examined it; therefore—for the present at least—our readers must be content with our pointing out some of the passages and remarks which we noted in looking over the work. Among them are some which hit hard at the new Royal Exchange, animadverting on the want of judgment manifested, in leaving that portion of it which is intended for the Exchange itself, uncovered; which, however, he admits to be a matter of taste; "for if our merchants prefer exposure to the inclemency of the seasons, it is not our business to complain of their fancy." But that is not all; for after speaking of the Bourse at Paris, as an excellent model for buildings of that class, he adds, "the merchants and city of London disgrace themselves by allowing [only] £150,000 for a similar purpose here; and even for this sum they cut up their building into little slices, to reimburse themselves by rents for the miserable outlay. So much for the spirit and liberality of the British merchant!" Though that spirit will most assuredly not obtain for its writer the freedom of the city of London, or any other civic honours, we freely vote it our approbation, since we must own that, compared with the flourishing promises that bid us look for a structure worthy of the first commercial city in the world, the Royal Exchange has sunk down into insignificance.[3]

With equal justice do the Church Commissioners come in for a very severe reprimand from Mr. Gwilt, who, in one place, says, "if ever a death blow was aimed at the art, that was done by the commissioners for building the recent new churches;" and in another, he talks of "true honest churches, one whereof is better than a host of the brick Cockney-Gothic things that are at present patronized, wherein the congregations are crammed to suffocation and not accommodated." It is, indeed, mortifying to reflect that although they have afforded employment to numbers in the profession, the buildings alluded to have not at all benefitted architecture itself.

But what shall we say of the severe strictures at page 612, on the present modes of architectural drawing, which contain so much for consideration that they would afford us matter for a separate paper? That in both exhibition and competition designs there is, now-a-days, an affectation of powerful pictorial display, by means of meretricious colouring, exaggerated and unnatural shadows and tricky effects—amounting sometimes to downright falsification, cannot be denied, and is likewise to be deprecated as an abuse, because it imposes on the eye, and draws away the judgment from a sober examination of the design itself. Yet while we deprecate the abuse, we are not quite disposed to go along with Mr. Gwilt into the other extreme, and forbid not colouring alone, but shadowing also. Very far, indeed, too, are we from being of opinion that architectural drawing has deteriorated since the time of Jones, Wren, and Vanbrugh; for we should as soon think of saying that architectural engraving has declined since the days of Holler. That Mr. Gwilt is perfectly sincere in what he says, cannot for a moment be doubted; for, though he may be aware that they are not likely to be very popular, he utters his sentiments not only without disguise, but in a tone sufficiently emphatic; for instance, —"the greatest curse that in these days has fallen on architecture, is the employment of draughtsmen, who, with their trumpery colouring and violent effects, mislead the silly men and common-place critics that usually decide upon the merits of their works." This is severe enough, nor is it entirely free from prejudice—a little overcharged, perhaps, both in opinion and expression, therefore Mr. Gwilt must not be very much surprised if some should attempt to retaliate, and charge him with making use of very coarse language; be that as it may, we ourselves do not like his work the less for its occasional pungency of expression, which, even when we dissent from the sentiment, is more to our taste than the smirking, wishy-washy style of many other writers.

The more practical part of the work contains a great deal of information—of course not entirely fresh, and therefore more or less familiar to professional men; but it renders this Encyclopædia a complete elementary course for the student, affording him, in a single volume, the instruction that he must else gather for himself from a variety of publications. Still, it is questionable whether it would not have been more advisable to publish some of the sections separately, in the form of a supplement to be bound up with the rest by those who choose to take it, because so much matter of that kind, incorporated as it now is in the volume, may deter not a few from becoming purchasers.

(To be continued.)

perhaps, because their opinion of it is no better than Mr. Gwilt's—we shall probably take up the subject ourselves.

[2] The omission of such names is all the more extraordinary, because that of Brettingham is inserted, notwithstanding the discredit attached to it even by Mr. G. himself, who remarks that he had the unparalleled assurance to send out to the world as his own, Kent's Designs for the Earl of Leicester's seat at Holkham—a contemptible and dirty trick, but not an unparaleled one in the history of architectural publications.

[3] Since shops there must be, the very least that can now be done is to take care that they shall be as little obtrusive in appearance as possible, to which end prohibitory clauses ought to be introduced into the leases, forbidding not only show-boards, but all display of articles at the windows, where only blinds should be allowed, with the names and business of the respective tenants painted on them. This could not be complained of, because the restrictions would be imposed alike upon every one, and no one is compelled to become a tenant if he should object to the conditions.

Ancient and Modern Architecture. Edited by M. JULES GAILHABAUD. London: Firmin Didot, and Co. Part 3.

Another part of this excellent work has appeared, which is fully equal in interest to the former numbers; it contains a rich specimen of the Lombard style, the Carthusian Church near Pavia, Italy: the façade is covered with most elaborate ornament, which is shown in detail in another plate. The third plate is a view of the Cathedral of Bonn, in Germany, a fine specimen of the Norman style; the principal elements, however, present in general, the characteristics of the modified Byzantine style, but not so pure as that style. The eastern apsis, with its two towers, seem to belong to the close of the eleventh century or the beginning of the twelfth. This edifice contains some excellent points, from which the architect may glean with advantage, and turn to good account for some of our new churches. We know of no work that will add so much to the taste of the architect as the one before us.

Turning and Mechanical Manipulation. By CHARLES HOLTZAPFFEL, A. Inst. C. E. Vol. I. London: Holtzapffel & Co., 1843.

We have been able only to give a cursory glance at this work, but from what we have seen, we have no hesitation in pronouncing it to be a work of the highest use, both to the practical man and the amateur. Next month we shall return to it.

SEWERS OF THE METROPOLIS.

WE are heartily glad that some agitation has taken place on this subject, having been introduced by the Poor Law Commissioners. We are sorry that we cannot insert Mr. Donaldson's defence, as chairman of the Westminster Commissioners, but we hope to advert to it next month; for although we do not agree with Mr. Chadwick in many points, we strongly hold that the present system of sewer administration is susceptible of improvement, so as greatly to relieve the proprietor and builder, and induce parties to construct sewers who now shrink from such a responsibility.

NOTES OF THE MONTH.

THE new Law Courts in Guildhall-yard are to be immediately erected from the designs of Mr. Tite, F. R. S. The elevation next to Guildhall-yard is to be in the Gothic style, and the buildings on the opposite side, now occupied as the Guildhall Police Office, &c., are, it is said, to be re-fronted, to correspond in appearance. Guildhall Chapel formerly occupied the site of the Law Courts, and the style of that edifice might well be used in the present design; at the same time we sincerely hope that the style of Guildhall front will not be adopted, but that the present opportunity will be taken advantage of to get rid of the cocked-hats and other barbarisms which Master Dance was pleased to call Gothic, and which we should call *Gothic par excellence!* Several of the Common Council have advocated such a course, and we hope will persevere.

The ground for the new Conservative Club, in St. James-street is cleared of the buildings upon it, and shows a frontage of 150 feet. The building, it is expected, will be commenced in the ensuing spring, from the joint design of Mr. Sydney Smirke and Mr. Basevi.

The restoration of Wells Cathedral has been entrusted by the Dean and Chapter to Mr. Cockerell, R. A., and it is at present to be confined to the choir and organ.

The Temple Church is fast approaching completion. The floor is being covered with inlaid tiles, manufactured by Messrs. Minton, of Staffordshire. Next month we hope to be able to give some account of the restorations.

The Lycian marbles discovered at Xanthus by Mr. Fellowes have arrived at the British Museum, and their public exhibition is awaited with much anxiety on account of the merit they possess. We have before expressed our opinion that much of value connected with Persian art remains to be discovered, and recent discoveries in the East tend to confirm this. The remains of Persian art which have as yet reached Europe, show a promise of something better than we have yet had, and illustrate the influence of Persia on Greek art, of which abundant evidence is shown in the Lycian marbles.

On the Travellers' Club a new attic is being raised, so as to relieve the garden-front now swamped by the Reform Club and Athenæum. The addition is in the same chaste style as the rest of the building. The only part which is looked upon with doubt is the inhersion of telescopic circular windows in the roof. The interior is to be decorated by Saug, a German artist, with arabesques, and used as a smoking-room. In reference to Barry's application of colour we have heard some remarks upon the decoration of the groined arcade at the Travellers' Club. This he has had painted in imitation of granite, thus appearing to violate probability, as it would be difficult to work granite in such a way.

The Noah's Ark on the top of the Mansion House has at last been removed, to the great satisfaction of the public.

Cateaton-street is rapidly advancing, and will make a fine street. Guildhall is, as we have announced, to be improved. St. Lawrence Jewry and Gresham Hall abut upon the street. The latter building is to have a highly decorated front, in the florid Italian style, of four Corinthian pilasters. It is by far too small for the purposes to which it is to be devoted.

The widening of Fetter-lane, at the Fleet-street end, is determined upon, and the houses have been removed.

Mr. Barry's works in Trafalgar-square now begin to show themselves. The shaft of Mr. Railton's Nelson column is nearly completed, and the bronze capital which is being cast at Woolwich is in an advanced state.

A new Hall and Library are to be built in Lincoln's-inn, from the designs of Mr. Hardwicke, and are, we understand, to be in the style of the old parts of Hampton Court.

We have seen a line engraving of Barry, by Hurland, which is in private circulation; it is 8 inches by 6¼ inches, and beautifully executed, but we do not consider it a striking likeness.

METROPOLITAN IMPROVEMENTS.

Whitehall, November 30th.—The Queen has been pleased to appoint the Earl of Lincoln, Lord Lyttleton, Lord Colborne, the Right Hon. James Charles Herries, the Right Hon. the Lord Mayor of the city of London, Sir Robert Harry Inglis, Bart., Sir Charles Lemon, Bart., Henry Thomas Hope, Esq., Henry Gally Knight, Esq., Alexander Milne, Esq., the Hon. Charles Gore, Sir Robert Smirke, Knt., and Charles Barry, Esq., to be Her Majesty's Commissioners for inquiring into and considering the most effectual means of improving the metropolis, and of providing increased facilities of communication within the same. The Queen has also been pleased to appoint Trenham Walshman Philipps, Esq., to be Secretary to the said Commission.

IRON STEAM VESSELS.

SIR—The writer of a paper on steam navigation in the November number of the *Journal* says, "The iron of which vessels are composed has been found to become brittle in the course of years, so that, although tough at first, it will, in the course of time, star like glass, when struck by a hard and sharp body." May I be allowed to remark that some of the friends of iron ship-building are startled by the assertion contained in this sentence, and would be glad to know whether the author of it can point to any instance of such "starring" which has actually taken place. Until this can be done, the examples of the *Aaron Manby*, which is stated in the same number of the *Journal* to have been at work from 1822 to 1830, without requiring any repairs, although she had been *repeatedly aground* in the Seine, *with her cargo on board*, and which vessel is also stated to be *now* at work,—of the steamer built by the Horseley Company for the Shannon, in 1825, and now "in good order," and of other iron vessels, do not appear to favour very strongly the serious objection raised against iron vessels in the paper quoted above.

I am, respectfully,

Neath, 12th mo. 10th, 1842. A. M.

[The objection alluded to by our correspondent is very well known to exist, by those whose acquaintance with the working of iron steam vessels is the most extended. In the *Lady Lansdown* iron steamer on the Shannon, the effect of a collision when the vessel was new was merely to indent the plate; after the vessel had been at work for some time, a tendency was observed in the plate to crack, as well as to become indented, and the brittleness of the plate was found to increase as the vessel became older, until, when struck by a hard and sharp body, it starred in the manner we formerly stated. Whether this effect is due to the action of the water or to the tremor occasioned by the engine, we do not pretend to determine; if the latter, steam vessels of moderate power may undergo a less rapid deterioration, and something of the superior durability of the *Aaron Manby* may possibly be owing to the smallness of that vessel's power.—ED.]

MEDHURST'S WATER VALVE.

SIR—Excuse my troubling you with the following remarks:—

I have been much surprised by repeatedly seeing reference made to a water valve invented by Mr. Medhurst, and particularly a description of it by Mr. Vignoles in his lecture in Cornwall, reported lately in the *Railway Times*, where he remarks that it is a very ingenious contrivance, the only objection being that the country the railway passes through must be perfectly level—a serious objection certainly, but not the only one; for the learned Professor surely cannot be so unacquainted with the principle of the common pump as not to know that when the tube is exhausted of air, the water will rush in to supply its place, and so render the tube ineffectual. Another objection is that the communication between the piston and carriage being on one side only, the pipe must necessarily be on one side also—a very unmechanical contrivance, to say the best of it. The chances of the water freezing, or rusting of the piston, are left quite out of the question.

A YOUNG MECHANIC.

CONTRIVANCE FOR DESTROYING SMOKE.

SIR—At a meeting held at the Leeds Music Hall about ten months ago, I had the pleasure of examining a variety of models and drawings of patented smoke-consuming apparatus; also of hearing the same explained by the inventors thereof, or by their representatives. Previous to this meeting, I had paid little or no attention to "smoke burning," as it is commonly termed, but since, I have done quite to the contrary; I have been continually on the listen, and in full expectation to see from an individual, whose signature has occasionally appeared in your pages, a contrivance to effect the object in question more agreeable to my fancy than any I had seen. My expectation in this respect not being realised, and perceiving from a printed notice received from the Leeds Board of Works, about three weeks ago, that the period is fast approaching when all the "wholesale smoke manufacturers" within the borough of Leeds will, by Act of Parliament, be compelled to check, to a great extent, that nuisance which has been so long complained of, I began to think it high time to do something by way of experiment to diminish the periodical dense volume which rolled from my own chimney-top.

During the last three or four months, I have had frequent opportunities of witnessing the operation of several different kinds of apparatus for consuming smoke, some of them patented and some not; the whole of which I found wanting some improvement to render them capable of accomplishing their intended purpose still more effectually. This circumstance caused me to try a plan of my own, the success of which has induced me to hand you the present communication. After all the discussion and bother that has of late been *driven* up and down the country concerning the consumption of smoke, "smoke burning" is, nevertheless, in my humble opinion, as far as Englishmen have been enabled to succeed in the *science*, attended with so little difficulty as to be accomplished with very little trouble and expense. My furnace was recently one of the ordinary description, though it is now entitled to the name of a "smoke-burner," and the difference of the state in which it now is, and that which it formerly was, is simply this.

Cold air being admitted through a regulating door or valve built in the wall on one side of the ash pit, into a space or chamber formed within the wall which supports the fire-bridge, ascends through a narrow aperture extending across the top of the bridge, that is from one side of the boiler to the other into the flue, where it mingles, with the smoke, and thus renders combustion more complete. The air thus admitted into the flue can have no good effect any longer than it assists combustion; for this reason, if the engine man be a little attentive, he will generally find that the air valve may be shut in about four minutes after each renewal of the fire.

There are many "smoke burners" now in constant operation in this neighbourhood, some few of them appear to answer tolerably well, while others, *of the very same plan*, appear to have no effect whatever. This circumstance renders it impossible for a stranger to distinguish the chimneys which have "smoke burners" attached to them, from those which have not. I do not mean to say the plan I here describe is a perfect remedy for preventing the smoke of chimneys; it is such as I am convinced will protect me against any interference of the Leeds improvement commissioners; it has a better effect in accomplishing its object than a great majority of those in the neighbourhood; and it is inferior to none I have yet witnessed, except in one point, and that is of all others the most important, viz. *expence*.

From your humble servant,

Near Leeds, *Nov.* 29, 1842. FLEECE.

[We did not think it necessary to give the drawing forwarded by our correspondent, as we consider that the description will be sufficiently understood without it; this "smoke burner" is, we believe, identically the same as one that was patented some years since, which patent has expired.—ED.]

BLAST ENGINES.

SIR—I shall feel obliged by an explanation from you or from some of your correspondents in an early number of your valuable *Journal*, of the following irregularity of *blast* from a blast engine.

The engine blows four furnaces, three on one side, and one on the other side. There are two receivers, one exactly opposite to the gable of the engine house, into which the air is first forced, and another situated nearly equidistant from the three furnaces on one side of the engine. The blast to the three furnaces is taken from the bottom of the receiver at the engine house, and to the other furnaces, within a short space of the top, and about one foot above the orifice through which the blast passes from the engine to the receiver. I applied a mercurial gauge to various parts of the pipe leading to the single furnace, and I found the pressure varying irregularly from a quarter to three and a half pounds on the square inch; whereas the pressure on the pipes leading to the three furnaces kept uniformly three and a half pounds.

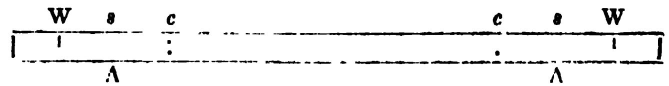
I am, Sir,
Your most obedient servant,

Clyde Iron Works, Glasgow, December 27, 1842. WILLIAM FERRIE.

ON THE STRENGTH OF BEAMS.

SIR—The above sketch shows the situation of the supports, &c., of a cast iron beam I lately had an occasion to make use of for carrying a load of about seven tons at each end. The distance between the supports *s*, *s*, was six times as great as that between the centre of each load, W, and the nearest support.

Now, I should feel myself highly obliged if some of your scientific readers would be kind enough to furnish the *Journal* with a correct method of shaping beams of this class; also the best formula for computing their strength. To prove where a beam of this kind would break, I took a parallel square bar of cast iron, divided its length, and placed it upon two supports, as seen in the sketch, then



submitted it to a pressure, acting equally upon the points, W, W, till it broke in the points *c*, *c*. Was I not to infer from this circumstance, that beams of the present kind require to be made strongest between the points of support? Query—Would this inference be consistent with theory? I don't remember seeing in any author on the subject, any satisfactory information relating to this class of bearers; still it is a form which in general practice is often found very convenient: and I have no doubt that if some of your able correspondents would give the subject a thorough investigation, the result thereof would be generally received as being of great practical importance.

Leeds, Dec. 17, 1842. CONCRETE.

OBSTRUCTIONS TO WINDOWS.

SIR—I have repeatedly endeavoured to obtain definite information on the subject of obstructions to windows (which have acquired a right by being opened upon adjoining property the requisite length of time) but having been unable to obtain any thing to be relied on, perhaps you, or some of your numerous and well informed correspondents can afford light on the following subjects.

1. Suppose a window to be opened upon an adjoining property, and (by neglect of the owner of such adjoining property) to acquire a right to remain open. What space of ground is required to be left open for its use, say in a direct line from its face, or the face of the wall in which it is built or opened?

2. Does the opening such window (of course it being possessed of the right as above) give any right to space on each side, or more than its own width.

3. Does it preclude the building of any structure beneath it, or as high as its sill.

These queries, you will perceive, are intended to cover all the ground of right of occupancy inherent in windows, which have been allowed to remain open a length of time sufficient to give what is termed a right of light.

By replying to the above, or giving it a place in your valuable journal,

You will oblige,

West Derby, Dec. 5, 1842. AN OLD SUBSCRIBER.

[We rather suspect that our correspondent will find some difficulty in obtaining a satisfactory answer to his queries, 1 and 2; we believe that there has not been any defined distance settled. At a trial, much depends upon the hard swearing of witnesses on both sides, as to whether a building erected near a window does obstruct the light and free circulation of air. After hearing of evidence, it is left to the Judge and Jury who may try the cause to determine the point. In answer to the third query, there is no doubt that the owner of the soil has a right to build beneath the window or as high as the sill; if in London, the roof must be 18 inches below or from the opening, to conform to the building act.—ED.]

SMITH'S PATENT WIRE ROPE.*

AT the Society of Arts, on Wednesday, the 14th December, a paper by Mr. A. Smith was read, "*On the properties of Wire, as applied in the Manufacture of Rope for Mining and Railway Purposes, Standing Rigging, Lightning Conductors, Cables, &c.*" After some preliminary remarks on the increment of strength, as compared with diminution of bulk, resulting from the processes of drawing and annealing the wire, Mr. Smith gave a table of the strength of single wires of various gauges, the breaking weights having been obtained by experiment with the testing machine. This was followed by a table of tests of the comparative strengths of the Government hempen-rope, and Mr. Smith's wire-rope, from experiments ordered by the Admiralty in March, 1837. Another table gave the comparative size, with the weight, and cost per fathom of iron-wire rope, hempen-rope,

and chain of equal strength. The general results are, that standing rigging of wire-rope, of equal strength with the hempen-rope, one-third of the size and half the weight, may be fitted at about two-thirds of the cost.

In the nautical statistics of Mr. Smith's paper it is stated, in reference to the advantages of a reduced surface of rigging, that "the standing rigging now fitted in her Majesty's navy, presents a surface of upwards of 800,000 square feet, which is about equal to the surface of the sails of twenty-four first-class frigates;" and in reference to the disadvantages of the absorption of moisture by the hempen-rope, that "one fathom of hempen-rope, about three inches in circumference, will absorb half a pound weight of water, and will contract one inch in length. The standing and running rigging of a first-rate measures about 30,000 fathoms, and will, consequently when wet, contract in length, on an average, about 880 yards, or nearly half a mile, and will absorb about seven tons of water, which, being principally carried aloft, will materially affect her sailing," &c.

Mr. Smith explained the construction of an apparatus termed a "screw lanyard," which he substitutes for the ordinary lanyards and dead-eyes of the shrouds, for the purpose of tightening the wire-rope rigging. It consists of a piece of Russell's wrought-iron tubing, with a screw at each end, working in right and left screw sockets.

The ship's lightning conductor is described as a copper-wire rope, securely fitted to the trucks and mast-head caps, and descending from the top-gallant and top-masts down the rigging, and over the ship's side, where it is inserted in a copper-plate, in contact with the sheathing below the water-line, &c.

On Wednesday, the 21st of December, Mr. Smith continued his communication. He commenced by explaining the tenacity and elasticity of various metals, and experimented by a testing machine on wires of platina, gold, silver, copper, and iron. He first tried a piece of platina wire, twelve inches in length, $\frac{1}{16}$ inch in diameter, and weighing 8 dwts. 5 grs; this experiment, however, failed from an accident. The gold wire, of the same length and size, (weight 5 dwts. 10 grs.) broke at 384 lbs.; silver, same size and length (weight 4 dwts. 14 grs.), broke at 260 lbs; copper, (3 dwts. 12 grs.) broke at 180 lbs.; and iron, 3 dwts., at 310 lbs. A copper rod, one-fourth of an inch in diameter, was then tested, which withstood a tenison of 2,000 lbs.; and an iron one, of the same diameter, did not break until a power was applied equal to upwards of 3,000 lbs. A wire bridge, of 33 feet span, was erected in the room, the construction of which Mr. Smith explained. The wire rope, forming its principal support, weighed 56 lbs.; the angle-irons, 112 lbs.; and the other parts, including the braces, 56 lbs.; and 112 lbs. for the platform or footpath, composed of boards —thus making the whole weight only three cwt., and which might be completed by four men, in about three days, at a cost not exceeding 15*l.*, and could, at any time, be taken down or put up in half an hour. These descriptions of bridges were described as very useful for military purposes, and for throwing over deep cuttings in railways, &c., Mr. Smith stated, that for general practical purposes the cost might be taken at 1*l.* per foot run, with a breadth of three feet. Two smaller models of bridges, on different principles of construction, were also shown.

KEENE'S MARBLE CEMENT.

At the Society of Arts a paper was lately read by Mr. White, "*On Keene's Marble Cement.*" It is described as a combination of sulphate of lime and alum. The gypsum undergoes the same preparation as for plaster of Paris, being deprived of its water of crystallisation by baking. It is then steeped in a saturated solution of alum, and this compound, when recalcined and reduced to a powder, is in a fit state for use. The cement has been extensively applied as a stucco, but the finer qualities (when coloured by the simple process of fusing mineral colours in the water with which the cement powder is finally mixed for working) being susceptible of a high degree of polish, produce beautiful imitations of mosaic, and other inlaid marbles, scagliola, &c. The cement is not adapted to hydraulic purposes, or for exposure to the weather, but has been used as a stucco in the internal decorations of Windsor and Buckingham Palaces. From its extreme hardness, it has been found serviceable when used for imbedding and setting the tiles of tesselated pavements, &c., and has been adopted for this purpose at the French Protestant Church, the new fire-proof chambers in Shorter's-court, and the Reform Club House. In the course of the discussion which followed, Mr. C. H. Smith and Mr. Lee adverted to the extreme hardness of the cement as its principal recommendation, when applied as stucco and for mouldings.

[We have seen some of the imitations of mosaic and inlaid marbles referred to in the above paper; we can say, and truly, that they are beautiful, and in point of polish superior to scagliola; we have also seen some fine specimens of granite, imitations in plinths for halls, chimney-pieces, columns, pilasters, &c.; and we must not forget to mention the imitation statuary mouldings, with polychrome ornaments, after the Greek. For the purposes of interior ornament, we consider this cement a great acquisition to the architect. We, therefore, strongly recommend the profession to visit Messrs. White's works, where may be seen various applications of the cement for decorative architecture, particularly two table tops, containing several imitations of rare marbles.]

THE SILLOMETER, DERIVOMETER, SUB-MARINE THERMOMETER, AND STEAM-ENGINE INDICATOR, OF M. CLEMENT.

At the request of a subscriber to give some information relative to M. Clement's Nautical instruments, for which Government lately made a grant, we make the following extracts from the *Mechanics' Magazine*:—

1. The *Sillometer* is the title given to a substitute for the common log, which has been recently invented by a M. Clement, of Rochfort, and is so well thought of by the French Admiralty, that it has been ordered to be forthwith supplied to the different ships of the Royal Navy of France. It is a most ingeniously constructed instrument, and promises to be of great practical utility. To describe it as well as we can in words:—

A hollow copper ball, against which the water acts, is attached to a moveable plug of the same metal, which slides in a copper tube that passes through the centre of the vessel to the keel; to this plug is attached a lever, which, by means of a vertical rod, acts on a second lever placed on the deck of the vessel, and communicating with a spring; the tension of the spring constitutes an equilibrium with the pressure of the water on the ball, and serves to measure the rate at which the ship is moving, by means of a hand, the movements of which on a graduated dial, indicate, at every movement, not only the speed of the ship, but also the distance run in any given time.

2. The second invention is called a *Derivometer;* it is an instrument to ascertain a ship's leeway, and is moved by a paddle, that may be placed under the keel at will, and is supported by a plug sliding in a tube like that of the Sillometer, but turning with the paddle and the rod. The motion is transmitted from the paddle and rod to two semi-circular dials, one of which indicates the leeway to larboard, the other to starboard. When at anchor, the instrument will show clearly the direction of the currents.

3. The third invention is a Sub-marine Thermometer. It appears from the thermometrical observations of many scientific navigators, that in seas of unfathomable depth, the water is not so cold as over banks, and that over banks near the shore it is less cold than over those at a greater distance, but colder than in the open sea. M. Clement's thermometer is kept constantly under water at the same depth, and indicates the different temperatures of the water by means of a dial placed on the deck of the vessel, and always open to examination. The immediate action is communicated by wheels, the working of which turns two hands upon the dial, the one marking the single degrees, and the other the tens. The whole is enclosed in a tube attached to the side of the vessel, and the helix of the apparatus is at the lowest part of the tube, in immediate contact with the water, and always at the same height.

4. The fourth invention consists of an instrument which indicates constantly the elasticity of the steam both in high and low-pressure engines, and the level also of the water in the boilers. The instrument may also be applied to the piston of an engine, so as to show the loss of power sustained by the steam in its way to it. A tube, similar to the manometer, is affixed to the instrument through which the steam ascends, and is introduced into a copper or brass box placed on the deck of the vessel, and upon which a graduated dial indicates, by means of a hand, to the officer of the watch, the effects of the engine, without his having to send below to ascertain it.

M. Clement has obtained patents for these different inventions both in France and this country.

The following experiments made by order of the Lords of the Admiralty on board of the *Lightning* steamer, we extract from the Government report.

"*Thursday, October* 13, 1842.

"About one mile and a quarter below Gravesend commenced a trial between Massey's patent log and M. Clement's sillometer. After a run of two hours and a half (being off Sheerness)—

	Miles.
"Distance given by Massey's log	$15\frac{1}{10}$
"Distance given by sillometer	15
"Distance from the Nore Light to Deal by sillometer	42
"Distance by tables	$41\frac{3}{4}$

"At 25 minutes past 4 o'clock, P.M., altered the course four points, during which operation the sillometer showed a diminution of speed from 8 miles per hour to 7 miles. At 50 minutes past 8 o'clock P.M., off South Foreland, commenced a trial between Massey's log and the sillometer.

"On Friday morning took in Massey's log, and found the distance from abreast the South Foreland to about 7 miles to the eastward of the Owers—

by Massey's log 84¾ miles; by sillometer 82¼; by tables 85 miles. Moved sundry weights aft, viz., boat, brass guns, anchors, oars, &c.: for an instant the speed, as shown by the sillometer, diminished to 7·4 miles per hour, but it almost immediately increased to the former speed of 8 miles per hour. Moved the same weights forward, but could not perceive any sensible difference in the speed of the vessel. The speed, as shown by the sillometer, varied from 8·1 to 8·2 miles per hour. Tried the speed of the vessel by the common log, which gave 8¼ miles. The sillometer indicated exactly the same. At 10 o'clock, A.M., on Friday, when about two miles past the Nab Light, tried Massey's log, and found the distance to near the entrance of Portsmouth harbour—by Massey's log six miles nearly; by sillometer six miles exactly. During the passage round to Portsmouth, the speed of the vessel was purposely checked, by blowing off the steam, to see the effect on the sillometer. The speed, as shown by that instrument, was gradually reduced from eight miles per hour to four miles, at which point it stood steady. On the order being given for full speed, the sillometer showed a gradual increase of speed, till it came to 8 miles per hour, as before. On the return of the *Lightning* from Portsmouth to Woolwich, the distance performed was found to be—by Massey's log 119 miles; by the sillometer 118·6.

"The sillometer has a dial upon deck, which constantly shows the number of miles per hour that the vessel is going; consequently it is easy to discover, under all circumstances, what is the best trim of the vessel, and the most advantageous quantity and distribution of the sails for obtaining the greatest speed. As the sillometer shows immediately the effect which every alteration in the sails or trim of the ship has on its velocity, it follows, also, that ships fitted with the sillometer can constantly maintain the speed they may have agreed upon, and so keep company together, and maintain the same relative position, though, from the darkness of the night, or thickness of the weather, they cannot see each other. To ascertain the distance run after any number of hours, it is simply to take the number of minutes one of the watches of the sillometer has gained over the other, and to multiply that number by six, which gives the distance run in miles.

"*The Marine Thermometer.*—The trials with this instrument on board the *Lightning*, commenced at 11 o'clock on Thursday morning, October 13, previous to leaving Woolwich harbour, and on taking the centigrade, it was found to be 12°. At 25 minutes past three o'clock P.M., in five fathom channel, cant-shoal, depth of water about 16 feet, it indicated 13·25°. In 23 feet depth of water, as stated by the pilot, it indicated 15·25°; off Dover 16°; and in Portsmouth harbour, 14·2. From these indications it appears that the marine thermometer in its variations followed the inequalities of the bottom of the sea, so far as these inequalities could be ascertained from the heaving of the lead, or from the information of the pilot—that is, on the aproach of shoal water the thermometer fell, and on the approach of deep water it rose, and distinguished the difference very distinctly and rapidly, according to the transition from shallow to deep water, and *vice versâ*. It may, therefore, be inferred that the marine thermometer would indicate the approach to rocks and icebergs, from the influence these bodies are known to have on the temperature of the sea for a considerable distance." The dial of the marine thermometer is also on deck, and shows, by inspection merely, the exact depth of water in which the vessel may be sailing at the time.

Sunderland Harbour Floating Dock.—Application is intended to be made in the ensuing Parliament for an act to authorise the Wear Commissioners to convert the lower part of the Tidal Harbour of Sunderland into a Floating Dock, by a course of dams, piers of masonry, with navigable gates between, across the River Wear. The works are intended to confine or impound seven feet of water above the low water-mark of the average spring tides in this part of the harbour; 100 acres of water will thus be rendered available to shipping, producing at Pallion a depth of five feet in the Channel, and at the Folly End an average depth of 12 feet. Facilities for moving ships in and out of loading berths, and increased accommodation for ships of a larger class, will thus be secured. The navigable gates to be each 80 feet in width of opening, with sluices or slackers in them for letting off the water when required. These gates are proposed to be left open till three hours after high water, or until the water has ebbed out to the height above specified. Ample time will, therefore, be given for ships passing outwards. The gates are to remain closed until the tide has again flowed to the level of the confined water, of three hours flood, when the tidal water will force them open, and the navigation of the stream will again proceed as at present. It is also proposed to construct a Tidal Dock or Basin, to contain 25 sail of vessels, for the purpose of having an entrance to the great Dock always available. Mr. Murray, the Commissioner's engineer, has prepared the necessary plans for the intended works. The Parliamentary plans have been lodged.

The New Barracks at Preston.—We understand that the plans and specifications for the new barracks at Fulwood, near Preston, have at length passed, and received the confirmation of the Hon. Board of Ordnance. They will be on the most magnificent and complete scale, superior to any in the kingdom, to accommodate 2,000 men, with stabling for 750 horses.—*Preston Chronicle.*

INSTITUTION OF CIVIL ENGINEERS.

The Council of the Institution of Civil Engineers have awarded the following Telford and Walker Premiums for 1842.

Robert Thomas Atkinson, M. Inst. C. E., for his Paper "On the sinking and tubbing, or coffering of Pits, as practised in the Coal Districts of the North of England," a Telford Medal in Silver, and Books.

William Cotton, for his "Memoir of Captain Huddart," a Telford Medal in Silver.

Chevalier Frederik Willem Conrad, for his "History of the Canal of Katwyk, (Holland,) with an Account of the Principal Works upon it," a Telford Medal in Silver.

James John Wilkinson, for his "Historical Account of the various kinds of Sheathing for Vessels," a Telford Medal in Silver.

Thomas Casebourne, M. Inst. C. E., for his "Description and Drawings of part of the Works of the Ulster Canal," a Telford Premium of Books.

Thomas Girdwood Hardie, Assoc. Inst. C. E., for his "Description and Drawings of an Iron Work in South Wales," a Telford Premium of Books.

Charles Nixon, Assoc. Inst. C. E., for his "Description and Drawings of part of the Tunnels on the Great Western Railway," a Walker Premium of Books.

Alexander James Adie, for his "Descriptions and Drawings of the Bridges on the Preston and Bolton Railway," a Walker Premium of Books.

John Brannis Birch, Grad. Inst. C. E., for his "Description and Drawings of the Bridge at Kingston-on-Thames," a Walker Premium of Books.

Robert Richardson, Grad. Inst. C. E., for his "Description and Drawings of part of the Works of the London Docks," a Walker Premium of Books.

James Combe, Assoc. Inst. C. E. for his "Description and Drawings of Messrs. Marshall's new Flax Mill, at Leeds," a Walker Premium of Books.

Charles Denroche, Grad. Inst. C. E., for his "Description and Drawings of the Apparatus used for Compressing Gas, for the purposes of Illumination, &c.," a Walker Premium of Books.

Adrian Stephens, for his "Description of the Explosion of a Steam Boiler at the Penydarran Iron Works, South Wales," a Walker Premium of Books.

George Ellis, Grad. Inst. C. E., for the Drawings illustrating the "Description, Specification, and Estimates of the Calder Viaduct, on the Wishaw and Coltness Railway; with the Series of Experiments on the deflection of Trussed Timber Beams for that work, by John Macneill, M. Inst. C. E.," a Walker Premium of Books.

Thomas Chalmers, Grad. Inst. C. E., for the Drawings illustrating the "Report on the Sinking of two experimental Brick Cylinders, in an attempt to form a Tunnel across the River Thames, by John Isaac Hawkins, M. Inst. C. E." a Walker Premium of Books.

THE NILE.

The following account of the plans adopted by Mehemet Ali for carrying into execution the improvements of the Nile, first conceived by the Emperor Napoleon, is transmitted to Paris by Dr. Labot, who arrived lately in Egypt. The first great work is to be the establishment of a bridge of 83 arches, running from the point of the Delta to each of the opposite banks of both branches, similar to the Pont-Neuf at Paris. On each side of the spur, a sluice is to be formed for the purpose of Navigation. All the 83 arches are also to be furnished with flood-gates of iron or wood, to be opened or shut, according to the wants of traffic and navigation. A tunnel is to be cut through the spur of the Delta, forming a communication between the two branches of the river. Canals are also to be cut from each branch running to the east and the west, with various minor channels, with sluices for the commerce and irrigation of the country. Above the bridge, the Nile is to be embanked on each side, so as to keep the water always within a certain level. All these embankments will be faced with masonry to give to them solidity and beauty. Concrete will be used for all the submarine works, and the rest will be done with squared stone, rubble, and bricks. These materials are found in abundance in Egypt, and even in the immediate neighbourhood of the works. Artificial pozzolano is in general use, being obtainable in all parts of the country from pulverised bricks. This matter, which is analogous to that produced by volcanos, being mixed with lime and rubble, form what is called beton or concrete. Before the discovery of this pozzolano, which costs 5 fr. the cubic metre on the spot, it was formerly brought from Italy, at the expense of 45 fr. or 50 fr. the cubic metre. The cost of the bridge has been estimated at 7,000,000 fr., and cannot exceed 10,000,000 fr. When once the materials are collected, it will require no more than three years for 5000 men to complete this colossal undertaking, which will vie in grandeur with the celebrated monuments of ancient Egypt. According to a calculation recently made by a Parisian engineer, it appears that the present irrigation of Egypt, though very limited in comparison to what will now be accomplished, costs the labour of 200,000 oxen and 100,000 men.

MISCELLANEA.

The Tomb of Napoleon.—The construction of the tomb of the Emperor Napoleon is about to be commenced, and for the last few days a model of the work has been exposed to public view at the Invalides. An equestrian statue of the Emperor is to be placed in the middle of the great court, and on the pedestal will be represented the arrival of his ashes at the place where they now lie. The entrance of the crypt destined to receive the Emperor's mortal remains will be ornamented on each side by two gigantic statues and two lions couchant. This entrance will be surmounted with an altar on spiral columns. The present grand altar and its rich canopy must be removed to admit of this arrangement.

The Tuileries and the Louvre.—The *Globe* notices a rumour, that during the next session of the Chambers the plan for uniting the palaces of the Tuileries and the Louvre by a screen, resembling in architecture the façade front of the Quay de Louvre, and thus forming one of the finest squares in Europe, will be presented. The centre will, it is said, according to this project, be ornamented with an equestrian statue of the Duke of Orleans, and the works are to be entrusted to the direction of the Civil List. The expense to be divided into thirds: one to be borne by the Civil List—one by the State—and the last by the city, to be laid out in embellishments. If this project be adopted, the idea of purchasing the site bounded by the Pont-Neuf, the Quais d'Horloge and des Orfevres, and the Rue du Harlay will be relinquished, and the new wing or screen of the Louvre will be appropriated to the Royal library.

The New Corn Exchange, Glasgow.—The spacious and beautiful hall which has been erected in Hope-street as a Corn Exchange, for the accommodation of those engaged in the grain trade, was opened on Wednesday 23rd November, for the first time, when the respective stalls were taken possession of by their tenants, and a good deal of business transacted. As this building, independent altogether of the important object it is destined to serve, is an ornament of a very high order to that part of the city in which it has been erected, we deem it worthy of a special notice. The exterior is finely relieved by a handsome range of Roman windows, and is decorated all round the spot with a massive balustrade, while the entrance which fronts Hope-street, is adorned with a beautiful portico, formed of Corinthian columns, 25 feet in height, finished with a corresponding entablature and pediment. The front has been designed in a style of great chasteness and purity, the work executed with much skill, and the entire building presents a noble and imposing appearance. The hall within is exceedingly spacious, and has a very striking aspect, being of a construction altogether different from that of any other building in the city. It is entirely lighted from cupolas tastefully introduced into the panels of the ceiling, and ornamented by a magnificent lantern light 50 feet by 30, formed in the centre of the building, and supported by eight columns, fluted, and ornamented in the Corinthian style. The dimensions of the hall are 80 feet by 57; the height of the ceiling 22 feet; and, viewed as a whole, it has an exceedingly light and elegant appearance. There have been erected round the hall 36 stalls for the grain merchants, so formed as to give facilities for exposing their samples, for writing, and otherwise carrying on business. They are let at the rate of 10*l.* each per annum, and we understand that 31 of them have already been taken, the name of each tenant being painted on his stall. Underneath the hall, which is reached by a short flight of stairs from the pavement, is a large grain store, perfectly capable of containing nearly 800 tons of grain. The building, so creditable to the parties chiefly connected with the grain trade, with whom it originated, has been built by subscription shares of 50*l.*; and the speculation bids fair for being a very profitable one. The architects are Messrs. Brown and Carrick, who, throughout the whole details, have manifested a degree of taste, skill, and ability, which cannot fail to add to their reputation.—*Glasgow Chronicle.*

Statue of the Queen at Edinburgh.—A colossal statue of Her Majesty Queen Victoria, is now being executed in freestone, by Mr. Steell, sculptor, and which is to be placed in the north front of the Royal Institution, Prince's-street. One stone is upwards of 22 tons weight: and was brought from the Binny Quarry to town on a wagon drawn by 16 powerful horses, assisted at certain difficult parts of the road by a number of Mr. Lhind's men. It was safely lodged in a large wooden building, Bread-street, where Mr. Steell is already far advanced in the formation of this gigantic structure, and which, when completed, will weigh altogether upwards of 90 tons. From the well known talents of the artist, the beauty and solidity of the Binny stone, and the commanding situation it is to occupy, this statue of our beloved Sovereign cannot fail to be an object of great attraction, and will complete the beauty of the splendid building it is intended to adorn.

Architectural Remains in Asia.—The *Commerce* states, that "most favourable news had been received from M. Tessier, appointed to direct the expedition sent to Magnesia, in Asia Minor, in order to raise the remains of the temple of Diana Leucophica. It appears that many more objects had been discovered than was originally expected, amongst others several columns in complete preservation, with their capitals sculptured with extreme delicacy, besides 12 bas-reliefs admirably executed, and a number of statues. The most friendly aid had been afforded by the French authorities in the Levant, and it is expected that a brilliant harvest is being reaped for the Academy des Beaux Arts at Paris."

The New Royal Exchange.—Notices have been given by the city authorities for pulling down the mass of building in front of the Bank (known as Bank-buildings) in the course of the spring, and the space, when cleared, is to be the site for the statue of the Duke of Wellington, immediately in front of the great portico of the Exchange. The progress made in the building itself is most astonishingly great, reflecting the highest credit upon Mr. Tite, the architect, and Mr. Jackson, the contractor. In the course of this year the work will be in great forwardness, and it will certainly be finished in the summer of the following year. The sculpture of the pediment Mr. Westmacott undertakes to complete by the 1st of May, 1844.

Timber Tank.—A wrought iron cylinder, 51 feet long and 6 feet diameter, has been erected in Portsmouth Dock Yard, for the purpose of "Burnettizing" timber under pressure. It is composed of plates half an inch thick, and double rivetted, and the ends are of cast iron, with doors 2 feet 6 inches square, for the admission of logs. It is fitted with two air pumps of 14 inches diameter, for extracting the air, and two force pumps for increasing the pressure when filled with the solution. On a trial lately made before the Admiralty engineer Mr. Kingston, the cylinder having been charged with 20 loads of timber, the air pumps which are arranged to be driven by Lord Dundonald's rotary engine, were set to work, and a vacuum of 26½ inches was obtained in 30 minutes. A cock in the connecting pipe was then opened, and the solution rushed into the vacuum from the cistern. When the cylinder was filled with the solution, the force pumps were set to work, and the pressure was raised to 200 lb. on the square inch. Under this pressure there was not the slighest leakage from any part of the cylinder, nor from the doors. The timber was removed on the following day, and a log was cut up, when it was found that the solution had penetrated to the very centre, and completely saturated it. The pressure at which the apparatus is in future to be worked, is 100 lb. on the square inch, as this is found to be sufficient for the due saturation of the timber within 24 hours, under the process of previous exhaustion of the air. The whole of the work was executed by Messrs. W. Fairbairn and Co., of London, and the cylinder rivetted up by their patent rivetting machine, to which its great tightness may be attributed.

New Iron Steamer, "The Magician."—An iron vessel, of 360 tons burthen, built by Messrs. Ditchburn and Mair, with engines of 110 horse power, by Messrs. Penn and Son, and fitted with Morgan's patent wheels, tubular boilers, and Howard's cooling apparatus, was tried during last month, and has proved to be a first-rate steamer; in point of speed she is not to be excelled. The following account of experiments we extract from the Woolwich correspondent of the *Times*:—The experiments were made on the 16th, 17th, and 18th of November. The vessel left Woolwich about ten o'clock, a.m., on the 16th, and in about half an hour afterwards passed the *Rhadamanthus*, which had left Woolwich at nine o'clock. At about half-past 11 o'clock she stopped for a few minutes at Gravesend, and then proceeded with a strong breeze ahead, and adverse tide, and at a quarter past one o'clock passed the Nore-light vessel; arrived at Ramsgate at 25 minutes past four o'clock, when the weather was so severe, that none of the London steam-vessels arrived during the course of day. The weather continued so boisterous during the 17th, that the *Widgeon* steam-vessel was under the necessity of putting into Ramsgate harbour at an early hour for shelter. The *Magician*, however, left Ramsgate shortly after 11 o'clock, a.m., the wind blowing at the same time a strong breeze from the eastward, and at 53 minutes past 12 o'clock passed Dover Pier, with a very heavy sea running. At 24 minutes past one o'clock, when opposite Folkstone, she put back for Ramsgate, where she arrived at 44 minutes past three o'clock. On the 18th the *Magician* left Ramsgate at 17 minutes past ten o'clock, a.m., with flood tide, and at 14 minutes past three o'clock, p.m., arrived off Woolwich. The average speed of the engines from Ramsgate to Woolwich was 35¼ revolutions per minute, length of stroke three feet six inches, height of steam-gauge seven inches, height of barometer 28¼ inches. The boilers are constructed on the tubular principle, very small, and generate steam well. The consumption of coal was about 6lb. per horse-power per hour, and the vessel was found to be extremely easy and dry in a heavy sea. The average speed of the vessel from Ramsgate to Woolwich, the distance being estimated at 85 miles, in five hours, was equal to 14 knots, or 17 statute miles per hour.

Dover.—Few persons are perhaps aware that our harbour commissioners have determined upon making the most extensive alterations and improvements for widening and generally enlarging the harbour; so extensive, no doubt, as to leave it beyond a matter of question that the Government intend making Dover harbour one of refuge. All the "old buildings," including the Dover Castle Inn, Amherst Battery, and the warehouses and buildings occupied by Messrs. Gilbee, Norwood, Spice, Dennis, Clarke, and others, are to be pulled down, and their sites thrown into the harbour. The whole of Union street also is to come down, with the exception of Messrs. Latham's Bank and the York Hotel. The railway will clear away Beech-street, the whole of the South Pier houses, and a part of Seven-star-street, which will include nearly all the shipwrights in Dover, not even excepting Mr. Duke, whose residence will also come down. These changes must have an extraordinary effect on all the trades of Dover, who will speedily be called into action for the purpose of supplying the "houseless wanderers" with places wherein to hide their heads.—*Dover Telegraph.*

New Locomotive Engine—"The Man of Kent."—Messrs. Rennie have turned out another locomotive that promises to excel the "Satellite," sent out by the same firm about 12 months since, and which has been working on the Brighton Railway with so much satisfaction and economy, the average consumption of coke being not more than 20 lbs. per mile, with a train of eight or nine carriages. It lately performed the distance from Croydon to Brighton, 40½ miles, with six carriages, in 52 minutes, including three stoppages of three minutes each, which deducted, make the actual time running only 43 minutes. During the whole period of 12 months it has been running not one shilling has been laid out for repairs. "The Man of Kent" promises even to excel these excellent qualities of the "Satellite;" it is a splendid specimen of engineering work, and possesses several improvements; among others is an important one of encasing the cylinders, which are 15 inches diameter, with a jacket, which will always be kept charged with hot steam; a second improvement, is the introduction of a damper, so constructed, that the apertures of the tubes next the smoke-box may be wholly or partially eclipsed simply by the driver turning a handle, which regulates the draft of the engine to the greatest nicety; a third improvement is in the regulator, which is generally circular consequently difficult to keep tight—it is now a slide valve. The centre of gravity is kept down by the spring being below instead of above the axles, as usual. We hope next month to be able to give some account of its performance.

South Eastern Railway Works.—The stupendous works now proceeding for the formation of the South Eastern Railway between Dover and Folkstone are rapidly progressing, and extensive preparations are making to throw down a large portion of Rounddown cliff, just beyond the Shakespeare tunnel, to make way for the sea wall. During last month experiments were made by the miners below the cliffs, under the superintendence of Lieut. Hutchinson, and General Pasley is expected to be present at the grand operation; this blast is to be effected by the enormous charge of 18,000 lbs. of gunpowder; it will be exploded by the electric spark from a galvanic battery, carried by conductors 1,000 yards in length. The experiments have hitherto been quite satisfactory, and it is expected at once to dislodge a portion of the cliff many tens of thousands of tons in weight.

Comparative Cost of English and Foreign Railways.—In Mr. Robert Stephenson's elaborate and important report, addressed to the directors of the South Eastern Railway, on the system of railways, as now projected by the French government, he gives an analysis of the cost of railways in England, selecting three lines—the Northern and Eastern, the York and North Midland, and the Birmingham and Derby—as cases similar in their results to those in France now under consideration; from this, and also an analysis of the cost both of the Belgian and French lines, it appears the average cost per mile of the English lines is 25,450*l.*, the French lines, 23,000*l.*, and the Belgian lines, 16,206*l.*; thus showing a difference in the cost in favour of the Belgian lines over the English of no less a sum than 9,244*l.* per mile, and over the French of 6,794*l.*

Burning Lens worked by the Drummond or Oxy-Hydrogen Light.—A colossal burning lens, three feet in diameter, and weighing 5 cwt., has been erected in the Royal Adelaide Gallery, intended to be worked by the Drummond, or oxy-hydrogen light. Some private experiments of this power of the Drummond light have taken place, when it was found that the bulb of a differential thermometer introduced into the focus, at a distance of 16 ft., was sensibly affected, and a piece of phosphorus introduced in the same point was fused. It has long been asserted that the heat accompanying light obtained by artificial means does not produce heat capable of being transmitted and concentrated through lenses; these experiments fully prove the contrary.

Price of Gas.—Gas is manufactured in Manchester by the Commissioners of Police, and though sold at from 5*s.* to 6*s.* the 1,000 cubic feet, yields a revenue of 12,000*l.*, or 15,000*l.* per annum to the town. The large consumers pay 5*s.* the 1,000 feet. [In Dublin the charge, when burnt by meter, is 10*s.* the 1,000 feet, and the quality so inferior in illuminating power, as to require the holes in the burners to be about double the ordinary size. If our civic authorities would follow the example of the Manchester Commissioners, it might prevent the necessity for a burgh rate, and confer a boon on the gas consumers.]—*Dublin Advertiser.*

An Immense Block of Granite has been landed at Mr. Tuckvill's wharf, Greenwich; it is from the Haytor Company's quarries, Dartmoor; measuring 10 feet 6 inches square, and weighs 22 tons. It is to be used as a covering for a mausoleum in Kensal-green Cemetery.

Bell Rock Lighthouse.—During the late heavy gales which have done so much damage to shipping, particularly between the 19th and 23rd of October, the sea sprays appear, by the monthly returns from the Bell Rock Lighthouse, to have risen upon the building to the height of from 60 to 90 feet every tide. While this heavy sea ran, one of those great detached masses of stone familiar to the lightkeepers by the name of "Travellers," was forced across the rugged surface of the rock, about 100 yards to the lighthouse, where it destroyed part of the cast-iron landing wharf. This stone measured about 7 feet in length, 3½ feet in breadth, 2½ feet in thickness, and must have weighed about 4 tons. To prevent mischief by the movement of these great stones, the lightkeepers are provided with quarry tools, with which they broke it up and arrested its progress, but it was no easy task from the run of the sea. The heaviest seas which visit the Bell Rock are from the North-east, but the present gale was chiefly from the North-west; and it is not a little remarkable that the Frith of Forth was but little affected during this storm above the Island of May.

Quarrying Stones.—Another remarkable example of the contributions of science to the arts of life is derived from the properties of heat, as applied in the East to quarrying blocks of stone, when the object is to excavate huge blocks from the surrounding mass. A groove is cut some 2 inches in depth in the required direction; this done, the groove is filled with fuel, which is kept lighted until the rock is highly heated. The rock then is, of course, expanded by the action of the heat; the fuel is then swept away, and cold water immediately poured into the groove. The sudden contraction causes the block instantly to split off. The same principle is daily exhibited on our tables. If a heated glass be suddenly filled with cold water, it immediately breaks in pieces. In this way blocks 80 ft. long and 6 thick are easily taken off with no other labour than that of chiselling out the groove. A similar example of the application of science to the economy of power is exhibited in France in the quarrying of millstones. They are required, as you are well aware, to be circular and flat—cylinders with a very small altitude compared with the diameter—and the stone from which they are made is exceedingly hard. The mode of quarrying them is this:—A very high circular column of stone is wrought out of the requisite diameter. To slice off portions of this, such as are required by the common stone saw, would be a work of immense labour, a quite different agent is employed. At regular successive distances grooves are cut around the column, into which are driven dry wooden wedges at evening. The dew which falls during the night being absorbed by the wood, causes it to expand with a power so irresistible, that all the stones are found properly cracked off in the morning. —Dr. Lardner: *Lectures in the United States.*

Seyssel Asphalte.—Many of our readers, may remember that some years ago, and previously to the introduction of asphalte into this country, we expressed our admiration of the pavement, composed of that substance in Paris, and especially of that in the Place de la Concorde, the whole of which has been long since paved with asphalte. It now behoves us to point out the piece of Seyssel asphalte laid down in April, 1838, in Whitehall, opposite the Horse Guards, as equal to the pavement in the Place de la Concorde, or in any part of Paris, and considering that its thickness is only half an inch, its having so long stood the traffic of so great a thoroughfare without any apparent change, except a greater smoothness of surface, is very remarkable.—*Times.*

NOTICES ON THE STEAM ENGINE, &c., IN REPLY TO CORRESPONDENTS.

We have been requested to correct certain alleged errors in our review of the Appendix E, F, to Tredgold, given last month. In reference to the engines of the Dee and Solway, a Greenock correspondent says—"The air-pump rods are cased with gun metal, and the iron at the lower end is secured by a brass flange jointed and screwed to the bucket, so that *no part* of the iron is exposed to corrosion from the salt water. The upper and under portions of the D valves are connected with three rods. (Is the writer of that article aware that Maudslays have only *one rod* in the engines of the "Great Western") The holding down bolts were made as requested by the engineer appointed to inspect the engines."

Our readers will probably recollect that our objection to the air-pump rods of these engines was, that they were cased at all. We have known instances in which this casing stripped off, and have been informed that some such accident did actually occur to the engines of the Dee or Solway. The expedient referred to by our correspondent, of covering up the end of the rod with a brass flange will, we fear, go but a little way in obviating the corrosion to which we adverted, for it is not at the extreme end of the rod, but at the neck of the rod, where any injurious corrosion takes place. The water insinuates itself to a certain depth between the brass of the bucket-eye and the iron of the rod, and eats its way up beneath the casing. We have known air-pump rods to be rendered unserviceable by this species of corrosion, when their extreme ends were comparatively uninjured.

The allusion to the practice of Messrs. Maudslay is, we suppose, intended to show that our strictures were shallow and hypercritical. Upon this point we shall leave our readers to form their own opinions, and shall content ourselves with expressing our gratification that Messrs. Scott and Sinclair have relinquished their old system in favour of that which we have all along recommended. It forms no part of our function to inquire at whose instance the holding down bolts, or any other part of an engine have been constructed in an objectionable manner; our purpose is not to find fault with any one particular party, but merely to express our conviction that certain practices are bad, and ought to be exploded. We war not with individuals but with errors.

Another Greenock correspondent informs us that the formula $45\left(\frac{1}{\theta}-\theta\right)$ given in the notes on "Steam Navigation" in our last month's number has been "altogether misapplied," because, indeed, we have alleged it to express "the rise or fall in temperature due to compression or rarefaction, without reference to initial density." Our correspondent favours us with an algebraic formula to prove his position, but our pages do not contain the allegation he charges upon them, we, therefore, think it needless to give the paper an insertion.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM NOVEMBER 25TH TO DECEMBER 22ND, 1842.

Six Months allowed for Enrolment, unless otherwise expressed.

Felix Napoleon Target, of Blackheath, gentleman, Leon Castelaine, of Backlane, Shadwell, chemist, and Adolphe Aubril, of Back-lane, aforesaid, artist, for "*a new method of refining or manufacturing sugar.*"—Sealed Nov. 25.

James Smith, of Coventry, card stamper, for "*improvements in weaving ribbons and other ornamented fabrics.*"—Nov. 25.

Charles Heard Wild, of Birmingham, engineer, for "*an improved mode of constructing floors for fire-proof buildings.*"—Nov. 25.

Isham Baggs, of Wharton-street, in the county of Middlesex, chemist, for "*improvements in producing light.*"—Nov. 25.

Frederick Oldfield Ward, of St. Martin's-lane, gentleman, and Mark Freeman, of Sutton, in the county of Surrey, gentleman, for "*improvements in candlesticks, apparatus, and instruments employed in the use of candles and rushlights.*—Nov. 25.

Pandia Theodore Ralli, of Finsbury-circus, wine-merchant, for "*improvements in the construction of railway and other carriages, and in apparatus connected therewith.*"—Nov. 25.

William Henry Fox Talbot, of Lacock Abbey, Wilts, Esq., for "*improvements in coating or covering metals with other metals.*"—Nov. 25.

Thomas Shaussell, of Birmingham, agent, for "*certain improved machinery for cutting or shaping leather, paper, linen, lastings, silks, and other fabrics.*"—Dec. 3.

Ebenezer Timmis, of Birmingham, manufacturer, for "*improvements in apparatus used for arresting the progress of and extinguishing fire.*"—Dec. 3.

Edward Cobbold, of Melford, in the county of Suffolk, clerk, M.A., for "*improvements in instruments for writing or marking, part or parts of which improvements are applicable to brushes for water-colour drawing.*"—Dec. 3.

John Stubbins, of Nottingham, hosier, for "*improved combinations of machinery to be employed for manufacturing certain parts of articles in stocking or lace fabrics.*"—Dec. 3.

Don Pedro Pouchant of Glasgow, civil engineer, for "*a certain improvement or improvements in the construction of machinery for manufacturing sugar.*"—Dec. 3.

John Sealy, of Bridgwater, merchant, for "*an improved tile.*" Two months.—Dec. 3.

Charles Heard Wild, of Birmingham, engineer, for "*an improved switch for railway purposes.*"—Dec. 3.

Thomas Howard, of Hyde Chester, manufacturer, for "*improvements in machinery for preparing and spinning cotton, wool, flax, silk, and similar fibrous material.*"—Dec. 3.

William Hancock, Jun., of Amwell-street, gentleman, for "*improvements in bands, straps, and cards for driving machinery and other mechanical purposes.*"—Dec. 3.

Frederick William Etheredge, of Frindsbury, gentleman, for "*improvements in the manufacture of bricks, tiles, and other similar plastic substances.*"—Dec. 3.

William Henry Stuckey, of Guildford-street, Esq., for "*improvements in filtering water, and other fluids.*"—Dec. 3.

William Pope, of the Edgeware-road, ironmonger, for "*an improved stove.*"—Dec. 6.

William Oxley English, of Kingston-upon-Hull, distiller, for "*improvements in purifying spirits of turpentine, spirits of tar, and naphtha.*"—(A communication.)—Dec. 8.

William Coley Jones, of Vauxhall-terrace, practical chemist, and George Fergusson Wilson, of Vauxhall, gentleman, for "*improvements in operating upon certain organic bodies or substances, in order to obtain products or materials therefrom for the manufacture of candles and other purposes.*"—Dec. 8.

William Smith Harris and Septimus Hamels, both of Leicester, cotton-winders and copartners, for "*improvements in the manufacture of reels for reeling cotton and linen thread.*"—Dec. 8.

William Kempson, of the Borough of Leicester, manufacturer, for "*improvements in the manufacture of muffs, cuffs, ruffs, tippets, mantillas, pelerines, dressing gowns, boots, shoes, slippers, coats, cloaks, shawls, stocks, cravats, capes, boas, caps, bonnets, and trimmings for parts of dress.*"—Dec. 8.

George Purt, of St. Mary-at-Hill, soda water manufacturer, and William Hall of Woolwich, engineer, for "*improvements in producing aerated liquors.*"—Dec. 8.

Richard Barber, of Leicester, reel manufacturer, for "*improvements in the manufacture of boots, shoes, and clogs.*"—Dec. 8.

John George Bodmer, of Manchester, engineer, for "*improvements in the manufacture of metallic hoops and tyres for wheels, and in the method of fixing the same for use, and also improvements in the machinery or apparatus to be employed therein.*"—Dec. 8.

William Edward Newton, of Chancery-lane, civil engineer, for "*improvements in the construction and arrangement of axles and axletrees for carriages, carts, and other vehicles used on rail or other roads.*—(A communication.)—Dec. 8.

William Lomas, of Manchester, worsted-spinner, and Isaac Shimwell, of the same place, worsted-spinner, for "*improvements in the manufacture of fringes, cords, and other similar small wares, and also in the machinery or apparatus for producing the same.*"—Dec. 8.

John Grantham, of Liverpool, engineer, for "*improvements in the constructions and arrangements of the engines and their appendages for propelling vessels on water.*"—Dec. 8.

James Brown, of Soho, Birmingham, engineer, for "*improvements in steam engines and steam propelling machinery.*"—Dec. 8.

Benjamin Fothergill, of Manchester, machine-maker, for "*improvements in machines called mules, and other machines for spinning cotton, wool, and other fibrous substances.*"—Dec. 8.

Percival Moses Parsons, of Waterloo-road, Surry, civil engineer, for "*improvements in steam engines and boilers, and in motive machinery connected therewith.*"—Dec. 8.

Charles Keene, of New Bond-street, hosier, for "*improvements in the manufacture of hose, socks, drawers, gloves, mitts, caps, comforters, and cuffs.*"—Dec. 15.

William Palmer, of Sutton-street, Clerkenwell, manufacturer, for, "*improvement in the manufacture of candles.*"—Dec. 15.

Thomas Cardwell, of Bombay, in the East Indies, merchant, for "*improvements in the construction of presses for compressing cotton and other articles.*"—Dec. 15.

Moses Poole, of Lincolns-inn, gentleman, for "*improvements in dressing mill stones.*—(A communication.)—Dec. 15.

Charles Maurice Elizee Sautter, of Austin Friars, in the City of London, gentleman, for "*improvements in the manufacture of sulphuric acid.*"—(A communication.)—Dec. 15.

Guillaume Simon Richault, of the Sabloniere Hotel, Leicester-square, editor of music, for "*improvements in apparatus for exercising the fingers of the human hand in order to facilitate their use in the playing of the piano forte and other instruments.*"—(A communication.)—Dec. 15.

James Winchester, of Noel-street, hatter, for "*improvements in steam boilers, and in the methods of applying steam or other power to locomotive purposes.*"—Dec. 15.

Edward Robert Rigby, and Charles John Rigby, of Gracechurch-street, brush manufacturers and copartners, for "*improvements in the manufacture of certain articles in which bristles have been or are now used.*"—Dec. 21.

Gabriel Hyppolyte Moreau, of Leicester-square, gentleman, for "*improvements in propelling vessels.*"—Dec. 21.

Gabriel Hippolyte Moreau, of Leicester-square, gentleman, for "*improvements in steam generators.*"—Dec. 21.

John Squire, of Ponghill, Cornwall, engineer, for "*improvements in steam boilers or generators.*"—Dec. 21.

Taverner John Miller, of Millbank-street, Westminster, oil merchant, for "*improvements in apparatus for supporting a person in bed, or when reclining.*"—Dec. 21.

William Bridges, of Birmingham, button-tool-maker, for "*improvements in buttons.*"—Dec. 21.

Henry Purser Valle, late of Fleet-street, gentleman, for "*improvements in combining mechanical instruments for obtaining power.*"—Dec. 22.

Joseph Beaman, of Smethwick, Stafford, ironmaster, for "*an improvement in the manufacture of malleable iron.*"—Dec. 22.

William Godfrey Kneller, of Wimbledon, chemist, for "*improvements in the manufacture of soda in the evaporation of brine, and in the concentration and manufacture of sulphuric acid.*"—Dec. 22.

Robert Wilson, manager at the works of Messrs. Nasmyths Gaskell and Co., at Patricroft, near Manchester, engineer, for "*improvements in locomotive and other steam engines.*—Dec, 22.

James Morris, of Cateaton-street, merchant, for "*improvements in locomotive and other steam-engines.*"—Dec. 22.

THE VARIATION OF THE COMPASS.

Observations made at the Royal Observatory, Greenwich,

G. B. AIRY, Astronomer Royal.

Mean Magnetic Declination for the month of September, 1842—23° 14′ 11″

The observations of the Magnetic Dip are suspended, when they are resumed the results will be recorded as usual.

NEW HYDROSTATIC ENGINE.—At the Taff Vale Railway, we learn, by the *Cambrian*, that a very complete hydrostatic engine is now at work, for the raising and tipping of coal, to be shipped from the terminus of the Taff Vale Railway, at the Bute Docks, Cardiff. It is only just set to work, but exhibits the principle of the hydrostatic balance very beautifully, and with the most perfect practical results.

BUILDINGS IN BELGIUM.

By George Godwin, Jun., F.R.S., &c.

"Perhaps no study reveals to us more forcibly the social condition and true feeling of passed generations than that of their monuments."—M. Guizot.

Chapter II.



Concerning the age of the Cathedral, there has been some controversy. Monsieur B. C. Dumortier, a member of the Belgic Chamber of Representatives and of the Royal Academy of Brussels, (and in company with whom the writer had the good fortune to examine the building) published first in 1837,[1] some remarks on the Cathedral, and then in 1841, a second pamphlet,[2] with a view to prove that the nave of the existing building belonged to the 6th century. These essays display much learning and ingenuity, but more enthusiasm, and this latter has served to blind the writer to all that militated against his desire to obtain unlimited reverence for his favourite building, and like an unruly Pegasus, has carried him far away from the goal he sought, namely the truth. Absence of direct statement by early writers that the nave was destroyed, serves to prove to M. Dumortier, (as in some similar cases it has been urged by other continental antiquaries) that it has not been rebuilt, and so far from the fact that pointed arches form an essential feature in it being deemed sufficient to weaken his opinion, it is proof strong as holy writ that the system of pointed architecture arose in Belgium, and that in the cathedral of Tournay is to be found its first out-budding. In confirmation of his opinion, M. Dumortier informed me, that a charter had been recently discovered dated 1257, proving that the architect of Cologne Cathedral was a Belgian. It sets forth that the monks of Cologne, in consideration of the services performed by Master Gerard, of St. Trond (*Gerardus de Sancto Trudone*), in directing the construction of their Cathedral, had assigned to him a certain estate of land.

Although apart from the present purpose, I cannot avoid repeating here a portion of the King of Prussia's speech when laying the first stone of the new works in completion of the last mentioned wonderful building. "Here where the ground stone lies," said the king, "here by these towers, will arise the noblest portal in the world. Germany builds it—may it be for her, with God's will, the portal of a new era, great and good. Far from her be all wickedness, all iniquity, and all that is ungenuine and therefore un-German. May dis-union between the German princes and their people, between different faiths and different classes, never find this road; and never may that feeling appear here, which, in former times stopped the progress of this temple—aye, even stopped the advance of our Fatherland. Men of Cologne, the possession of this building is a high privilege for your city, enjoyed by none other, and nobly this day have you acknowledged that it is so. Shout, then, with me, and while you shout will I strike the ground-stone,—shout loudly with me your rallying cry, ten centuries old, "Cologne for ever!" And then, while a thousand voices re-echoed "Cologne for ever!" the ancient crane on the top of the south tower was once again put into motion, and was seen slowly raising a ponderous stone. The amount both of time and money required to complete the Cathedral renders the issue somewhat doubtful. Let us hope, however, that this fear may be unfounded, and that this magnificent building may gradually gain its intended proportions—an emblem of unity, a worthy offering to God, and an ornament to the world.

To return, however, to Tournay; there is sufficient evidence to induce the belief that the Cathedral was founded at the end of the 3rd century, and rebuilt about the middle of the 5th century, with the aid of Clovis, by St. Eleutherius. Chilpéric in 578, endowed the Cathedral largely, and his original deed of gift "*cum sigillis*," remained amongst the archives of the chapter until they were burnt in 1566.[3] Louis le-débonnaire added to the cloisters of the Cathedral in 817, and Charles the Simple further endowed it. Soon after this, however, namely in 882, the Normans ravaged Belgium with fire and sword, and inspired such universal dread, that the people, adding to their prayers "from the fury of the North-men, Good Lord deliver us," fled in all directions. Tournay, rich and important as it then was, did not escape; the walls and the chief buildings were destroyed, and the inhabitants were forced to abandon the town, to which it seems they did not return until the beginning of the 10th century. At the time of this invasion there can be little doubt the Cathedral was pillaged, and partly if not wholly demolished; and it is probable that its re-erection was not attempted until quite the close of the 10th century, in which the inhabitants returned, or rather the beginning of the 11th. All analogy shows that earlier than this, the nave and transepts could hardly have been commenced, and that it was probably much later before they were completed.[4] If analogy, however, were deemed insufficient to remove

[1] "*Revue de Bruxelles*," Dec. 1837.

[2] "*Dissertation sur l'age de la Cathédrale de Tournai.*" *Bruxelle*, 1841.

[3] The deeds must have been very numerous, if we believe a contemporary writer, who says that the melted wax from the seals formed a stream down the hill.

[4] It is but fair towards M. Dumortier to give, in his own words, his argument against the assumed destruction of the Cathedral by the Normans:—

"L'histoire de la translation du corps de Saint Eleuthère sous l'évêque Hédilion en 876, immédiatement avant l'invasion des Normands, nous fait connaître qu'à cette époque l'on avait démoli la chapelle de Saint Etienne, qui était située à la suite de la cathédrale. Voici comment s'exprime la chronique écrite au XIe siècle: *Presulatum tornacensis ecclesiæ Heidelom viro prudenti et justo possidente, basilica beati Stephani prothomartyris, quæ sita est post ecclesiam Christi genitricis semperque virginis Mariæ, destructa est* *

Le soin que prend le chroniqueur à nous apprendre la destruction de la chapelle de Saint Etienne annexée (?) a la Cathedrale, indique clairment la conservation de celle-ci. Si ce vaste monument, dont l'existence est démontrée et au VIe et au IXe siècle, avait été détruit lors de l'invasion des Normands, le chroniqueur se serait-il borné à nous apprendre la destruction d'une de ses parties? C'est ici que s'applique se vieil adage; *inclusio unius, ex-*

* *Elevatio corporis beati Eleutherii tornacensis episcopi et confessoris; MS. in Libro Sancti Martini Tornacensis.*

the ground for controversy respecting the age of the cathedral, it would seem to be destroyed by the recent discovery of a M. S. entitled "*Ritus Officii divini ecclesiæ Tornac,*" and dated 1656. This gives a list of the various fêtes formerly celebrated in the Cathedral, and points out the 9th of May (which was then annually celebrated), as the anniversary of the dedication of the church, in the following words: "*Dedicatio ecclesiæ, est festivus dies in populo intrà muros. Triplex est cum octavâ et duplex primæ classis;*" and then, "*Videlicet novæ, anno* 1066." Monsieur T. Le Maistre d'Anstaing, who mentions this MS. in his very interesting work on the Cathedral,[5] remarks that doubtless there were more consecrations than one, as for example that of the choir, and those after partial restorations; but that this being the first, was properly regarded as the most important, and, being duly observed, had been handed down to the date of the MS. alluded to.

In a comparatively short space of time after this date, if the historian Jean Cousin is to be believed,[6] the choir becoming too small and probably being injured by the events of troublous times, was cleared away to make room for a more magnificent structure. Cousin states, that the first stone of the new choir was laid in 1110; and that it was finished about 80 years afterwards or more. His authority for this statement, however, does not appear. According to certain old chroniclers quoted by M. d'Anstaing, it was vaulted in 1242, at the expense of Walter de Marvis; but it would seem that divine service had been performed in it previous to that date, its dedication being ascribed to the year 1200.

At the end of the twelfth century, pointed architecture was but just developing itself, so that we must conclude either that the choir of the Cathedral of Tournay is one of the earliest monuments of that style, or that the received statements are erroneous. I am inclined to believe the former.

In concluding these remarks on the Cathedral of Tournay, it is gratifying to be able to say, that the sum of £20,000 has been voted by the nation (to be expended in ten years) for the restoration of this noble building, and that under the direction of M. Renard, the architect, there is every reason to expect it will be carried out efficiently.

When speaking of the Town Hall at Louvain, the writer intended mentioning, that what is stated to be the original drawing of the west front of the Cathedral of that town is preserved there, together with a very elaborate and beautifully executed model of the same in stone as it was executed, with a singularly lofty tower and spire in the centre, and another on either side of it; only one of the side towers, however, is shown. The drawing is on vellum, 9 ft. high and 2 feet 9 inches wide, and is coarsely but carefully executed. The model is about 24 feet high and 7 feet 6 inches wide at the base, and is now in an excellent state of repair. The centre spire, which is said to have been above 500 feet high (an extraordinary elevation, exceeding, by 100 feet, that of the spire of Salisbury Cathedral) was destroyed in 1606 by a storm, and in its fall ruined the side towers.

clusio alterius. Ainsi il demeure démontré que la Cathédrale de Tournai ne fut pas detruite à cette époque, et qu'elle resista à l'invasion Normande. En effet, celui qui a vu ce noble edifice et considére l'épaisseur des colonnes de sa partie romane, la solidité des matériaux employés a sa construction, n'hésitera pas à reconnaître qu'avec de tels matériaux il existait des conditions de duree que l'on ne retrouve pas dans les églises des provinces Rhénanes, et qu'ainsi s'explique pourquoi Nôtre Dame de Tournai a pu résister à une époque où tant d'autres édifices religieux ont succombe. Au lieu d'être construite comme les eglises des bords du Rhin en un calcaire sablonneux, friable et de peu de duree, la basilique de Tournai est construite en calcaire anthraxifère, espèce de marbre tres dur, et faisant feu sous le briquet. Pour detruite un édifice aussi gigantesque, et composé de pierres aussi solides et aussi massives, il faudrait de milliers d'ouvriers et un travail de plusieurs années. Or, les Normands avaient toute autre chose a faire que de passer leur temps à un tel ouvrage. Aussi, tous les chroniqueurs et les historiens de Tournai ont parlé de la Cathédrale, et l'on ne trouve, dans leurs écrits, aucune indication d'où l'on pourrait induire que ce vaste monument aurait été detruit et reconstruit à la suite de l'epoque carlovingienne. Au contraire, preuve certaine que l'édifice etait dejà bien vieux à cette epoque, il est constant que le chœur roman fut demoli vers la fin du XIe siecle, et qu'en l'an 1110, l'on commença la construction du chœur actuel, l'un des monuments les plus vastes et les plus hardis de l'art gothique."

[5] "*Recherches sur l'Histoire et l'Architecture de l'Eglise Cathédrale de Notre Dame de Tournai.*" 1842.

[6] "*Histoire de Tournay par Jean Cousin.*" *Douay,* MDCXX.

The interior of the Cathedral affords an excellent specimen of pointed architecture. The choir is separated from the nave by a highly decorated rood-loft of three arches with numerous sculptured figures under canopies. Above the loft is a rood of very large size, with figures of the Virgin and St. John at the foot (without which a rood was not deemed complete) profusely adorned with colours and gilding.

The font, situated at the west end of the nave, has an elaborate Gothic crane of iron attached to the wall near it, for the purpose of supporting the cover, now removed. One of the chapels in the north aile of the nave has a balustrade or low screen of coloured marbles, exquisitely sculptured in the style of Louis XIV. And under the arch which separates the choir from its side aile, on the north side [illegible] grand altar, is a sculptured stone tabernacle of very elaborate [illegible] reaching the whole height of the arch, perhaps a[illegible] a hexagon in plan, tapering upwards to a point, and [illegible] small pillars round its circumference, and one in the centre.[7]

The pulpits found in the Belgic churches are in many cases remarkable for their large size, the profusion of materials employed, and their elaborate workmanship, rather than for good taste and propriety. The pulpit in the cathedral under notice (situated as most of them are, on the south side of the nave) represents the conversion of St. Paul. The saint and his horse are on the ground; on the west side of them stands the figure of a man gazing with astonishment, if I remember rightly, at the miracle; a huge mass of rocks and trees supporting angels and birds forms the chair itself. Behind rise two lofty fir trees, from the stems of which, about midway, extends the canopy or sounding board, adorned with angels and other carved decorations.

The pulpit in the Cathedral at Malines (a most interesting town) represents the same subject, but is differently arranged. St. Paul and his horse are on the ground at the foot of a mass of rock forming the body of the pulpit. Our Saviour on the cross, the Virgin, and other figures, enter into the composition; a stem of a fallen tree serves as a rail to the stairs: and a continuation of the rock work, from which the Holy Spirit in the shape of a dove, descends over the head of the preacher, forms the canopy.

In the church of St. Andrew, at Antwerp, the pulpit represents Andrew and Peter called from their nets by our Saviour. It is ascribed to Van Hool and Van Gheel. The pulpit in the Cathedral of the same city is a curious composition, consisting of twining shrubs and birds, said to be the work of Verbruggen. This artist also executed the pulpit in St. Gudule, at Brussels, which represents the expulsion of Adam and Eve from Paradise, and is perhaps better known than any of those I have already mentioned. The pulpit at Nôtre Dame, in Brussels, is a representation of Elijah fed by ravens. In some cases part of the sculpture is in wood and part in marble; as for example, in the Cathedral at Ghent, where the pulpit is of large size and elaborate design, embracing many figures.

In 1838 the writer laid before the Royal Institute of British Architects, a series of drawings illustrative of the ruins of the ancient monastery of St. Bavon in the city last mentioned, namely Ghent. These remains are situated in the old citadel on the eastern side of the town near the Antwerp Gate, a quarter not generally visited. They consist chiefly of a large rectangular building unroofed, the remains of cloisters, and a small octagonal building of two stories, (known as the chapel of St. Macaire) communicating with the cloisters and standing within the square court surrounded by them. The accompanying sketch (Fig. 3,) represents the interior of the lower story of the chapel which is much more perfect than any other part of the building. It is vaulted with rubble stone with flat shallow ribs diverging from the centre, and terminating in large corbels of columnar form. The vault has been covered with stucco, and ornamented with colours, now for the most part destroyed. One of the eight sides of the building is wider than the others, for the purpose of admitting a double archway of the cloisters, and a second side is occupied by an

[7] In the church at Léau, a place little known, there is a tabernacle of somewhat similar outline in the style of the *Renaissance*, and of very extraordinary workmanship.



altar, the top stone of which is marked, as is often the case with ancient altar stones, with five small crosses, one at each corner and one in the centre, the latter being the larger.[8] Each of the other sides has a semi-circular arched way in it. The building is paved with black and red tiles about 4 in. square each.

In the rectangular building and cloisters which present the work of several periods, the columns where they remain are very short, and have leafed capitals similar to some in Tournay Cathedral. They are formed of the grey Tournay stone, and in some few instances have octagon shafts as is also the case in the Cathedral. The arches of the cloisters were pointed; they were formed of brick, with stone ribs and corbels (sculptured with foliage and figures), and were of more recent date than the walls. The rectangular building is paved with red, yellow, and black, glazed tiles of various shapes and sizes (some being very small) disposed in patterns.[9]

The history of this building ranges over a considerable period. In the year 636, King Dagobert of France, sent St. Amand to Ghent to preach Christianity. St. Amand having made many converts, founded two monasteries, one of which was on the site of the remains in question. A few years afterwards, Allowin, surnamed *Bavon*, was induced by the teaching of St. Amand to quit the world, and having given the whole of his property to the latter monastery, obtained permission to construct a cell in the neighbouring wood, where he died in 654. The monastery then took his name, a church was dedicated to him, and the whole quarter was termed, for many years, the town of St. Bavon. In 816, the monks fled to avoid the Normans, and took refuge in England. John of Gaunt was born in this monastery in 1341, and at the beginning of the 16th century the whole establishment was destroyed, in order to construct a citadel on the site.[10]

In the "*Notice Historique de Gand*" it is stated that in 1067, Baudouin, Bishop of Noyou, and Liebert, Bishop of Cambray, consecrated the church of St. Bavon, and deposited there, in a private chapel, the relics of St. Macaire, who, it was supposed, had freed the city from the plague by his prayers, some few years before. The style of the octagon building before mentioned, still called the chapel of St. Macaire, agrees with this date satisfactorily.[11]

[8] The crosses upon ancient altar stones were intended to mark the spots anointed with chrism at its dedication. A Pontifical printed at Rome in 1595, and now preserved in the British Museum, shows that a bishop when consecrating a church, was enjoined to mark with his thumb dipped in the chrism, twelve crosses on the walls of the church, and others on the door, altar, &c.. See *Archæologia*, vol. XXV, p. 243, 275.

[9] The area of the cloister is about 100 feet square; the diameter of the octagonal building is about 20 feet.

[10] The abbot and monks were removed to the cathedral church of St. John the Baptist, in the city of Ghent, from that time called the church of St. Bavon.

[11] I cannot omit mentioning with reference to Ghent, that M. L. Roelandt to whom the city is indebted for many important buildings, (amongst them the most elegant little theatre and ball-room that I know of,) is engaged upon a new *Palais de Justice* of large extent. The window dressings of the principal floor have more than ordinary importance given to them. and form a principal feature in the façade. They consist each of two disengaged Corinthian columns supported on corbels, with entablature and pediment, and corresponding pilasters on the face of the building.

CANDIDUS'S NOTE-BOOK.
FASCICULUS XLV.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. ALTHOUGH not propounded *ex cathedrâ*, the doctrine broached by the Premier Professor, has made quite a sensation, filling all with surprise, and some with a panic feeling. It is the opinion of more than one in the profession that our architectural Professors are nearly all bewitched. As if it was not enough to have Hosking preach down Vitruvianism, we have now Cockerell preaching up rank architectural Radicalism. He goes to the extent of turning every thing topsy-turvy, without regard to those most comfortable of all things—our prejudices. What is to become of our reverence for precedent and authority, if copyism is henceforth to be proscribed, and every one expected to give us his own ideas. It may be all very well for those who possess taste, and have ideas of their own; but then what is to become of those poor devils who have none? If they must neither borrow nor steal, their fate will be hard indeed. While Professor Pugin would merely lead us back to the "dark ages," bidding us look for light and enlightenment there, the Royal Academy Professor would fain turn us adrift, to grope about in more than Egyptian darkness. Surely it is better to be tethered to a stake with a yard or two of rope, than to have the precious liberty of rambling at will blindfold among pitfalls and precipices. So, at any rate, think some. After copyism has served them so well, they must now hear it reviled by the ugly epithets of "dull" and "unmanly"! and that by a Professor, too! Why, he might as well have called it *stupid* and *old-womanish*, for that was, no doubt, his meaning. As to *invention*, that is, of a truth, most venturesome work, but then, be it remembered,

"Things out of hope, are compass'd oft by vent'ring."

II. It argues very great forbearance on the part of Welby Pugin that he has not had a fling at Abbotsford, for it is certainly quite as miserable and trumpery as any of the architectural "monstrosities" he has shown up in his "Contrasts," or quizzed in his "True Principles," although concocted out of the ideas of so many persons who were successively consulted by the "Great Magician," but who have shown themselves to be no conjurors. Stark, Terry, Burn, Blore, Atkinson, all prescribed in turn, and bedoctored till they bedevilled it. Whichever be the best of Scott's works, Abbotsford is decidedly his worst—mere "Carpenter's Gothic," and a "Tea-Garden Castle." Fortunate would it be for the credit of his own taste, and also for the credit of those employed upon that pet fancy of his, were it to be demolished at once, instead of being piously preserved as a monu-

ment of Scott's *virtuosity* in architecture. Attempts in the Gothic style by Scotch architects are almost without exception intolerably bad, many of them utterly contemptible. Taymouth Castle, about which the newspapers made so much fuss a few months ago, is in point of architecture, most miserable. The noble owner of that big house possesses an infinitely superior specimen of architecture in a small one called the Forest Cottage, which he has lately erected in Inveroran. Homely in character, as its name denotes, yet at the same time something more than a mere cottage, it idealizes that character most happily, bringing forward some of its most picturesque traits, without any paltry affectation. It is withal eminently picturesque, which is more than can be averred of those things which pretend to be "Picturesque" by title, and for the nonce.

III. That the lord of Abbotsford himself could be sufficiently severe upon other persons' architectural whims, is evident from a postscript of a letter of his to Mr. Morritt, of Rokeby Park, and who was then at Brighton; saying, "Will you do me a favour? Set fire to the Chinese stables, and if it embrace the whole of the Pavilion, it will rid me of a great eye-sore"!! As this was written in the February of 1826, immediately after the crash that laid low his fortunes, and reduced him to beggary—at any rate to that sort of nominal beggary which thousands would call luxurious affluence—hardly is it to be supposed that his so expressed opinion of the Pavilion at Brighton was a mere sally of wantonness and *gaieté de cœur*. The Pavilion might have been rendered a good specimen of the style it pretends to, and so far have been satisfactory, whatever may be objected to the choice of such style for such purpose. Instead of which it is a finical and insipid, not to say paltry imitation of that style, with little character than that of toyishness and gimcrack, certainly with no "heartiness of character" about it, nor any *gusto*. The "pimping pagoda taste" of George IV. is not yet extinct in the family, for a Chinese conservatory, or something of that sort, is now erecting in the gardens of Buckingham Palace, but whether it is of porcelain, or common crockery quality, is not said.

IV. Were the reviewers to pay Mr. Gwilt in his own coin, they would say nothing of his book, except that, being the work of a living contemporary, delicacy prevented them from expressing any opinion relative to it; besides, their silence would be far more gratifying than any remarks, however complimentary, from a class of critics whom Mr. Gwilt himself denounces as a set of meddling blunderers and blockheads. He has shown himself most dreadfully sore upon the subject of reviewers and anonymous criticism, and for no other reason, it appears, than because an article in the *Foreign Quarterly* spoke in commendation of Schinkel and the German school of architecture. Any other person than Mr. Gwilt would have been thankful for the information there first conveyed upon the subject, whether he agreed with all the writer's opinions or not: whereas the meek Joseph assailed him as virulently as if that article had been a personal attack upon himself, and spluttered in a very big strain about "small fry" writers and anonymous critics—or rather those who set up for critics, though utterly ignorant of the subjects they profess to treat. Does Mr. Gwilt then suppose that professional men never write in literary journals, on subjects connected with their own pursuits? Is he not aware, poor man, that among the anonymous scribblers in the periodical he fell foul upon, there was no less a nobody than Sir Walter Scott? Can he be so ignorant as not to know that Cowper, Byron, Southey, Moore, Hallam, Brougham, Horner, the Rev. Sydney Smith, not to mention Bishops, have been anonymous reviewers? It will be well for him should he not find out at last, that it had been better had he condescended to publish anonymously, himself. None will envy him the fame he will now get by not doing so.

V. "Nothing is so tiresome," says Sir Walter Scott, "as walking through some beautiful scene with a *minute philosopher*, a botanist, or pebble-gatherer, who is eternally calling your attention from the grand features of the natural picture, to look at grasses and chucky-stones." *Mutatis mutandis*, this may be applied to those minute critics in architecture who attend chiefly to inferior matters, such as the proportions or correctness of an order as an order, without regard to any further effect, or its coherence with the rest of the building. Any thing of that kind which happens not to be in distinct conformity with standard, and therefore only general, rules,—which we are rather to be guided by than tied down to, is at once pronounced by them to be faulty and incorrect, yet at the same time they can tolerate infinitely greater faults, far more reprehensible licenses, and that which is the greatest defect of all, let the style be what it may, the utter want of all artist-like feeling. By a minute critic, however, is not to be understood one who examines merely the minutiæ and details of a building—for that is more than every one of the tribe is capable of doing: but one who looks at every thing piecemeal, and who dwells exclusively upon individual particulars and detached circumstances, without taking into consideration whether there be any thing to call for, to justify, or to account for what he only perceives to be uncommon. Your minute critic is generally a staunch stickler for precedent, and not without reason, since precedent and authority are the crutches which help him along. Deprived of their aid, he comes to the ground. In any case out of the ordinary course he feels quite *put out*, and unable to make any thing of it, takes his revenge by pointing out what does not accord with usual practice, and therefore, as he will have it, a blunder or a solecism. How the minute philosopher chuckles when he detects some *homœopathically* small infringement of a mere pettifogging rule. Yet how obtusely blind is he apt to show himself in regard to every thing which does not come within the compass of rules and routine.

VI. By no means would it be amiss were public spirit and architectural zeal to be displayed in completing and giving the finishing touches to some of our modern buildings, as well as in the restoration of decayed ones. Many there are which admit of being greatly improved by corrections, and by omissions in them, more or less obvious, being supplied. Such is certainly the case with the National Gallery for one, and there even seems to have been some idea at one time of doing something more to that building, Barry having actually been consulted on the subject. Greatly might the United Service Club House be improved by giving it a cornicione, and throwing more spirit and richness into its other features. Nay, perhaps even the Conservative might be converted into a tolerably satisfactory design, were *carte blanche* for such alteration to be granted to some one who possessed both ingenuity and taste. At all events we may now expect to find that that building has served as a wholesome warning to the architects of the forthcoming new Conservative Club House in St. James's Street, and that they will show themselves Radical Reformers in point of architectural taste.

EXPRESSION IN ARCHITECTURE.

The expression, or as it is sometimes termed, the language of architecture, is a subject which has engaged the attention and employed the talents of many writers, both amongst professors of the art and others, nor is it at all uncommon to hear it said that every building which makes any pretensions to style and taste, should express by its design and character, the purpose for which it is intended. Although it is by no means my intention to deny that buildings of almost every class are capable of great and varied expression, yet to suppose that this expression may be varied so as to indicate all the different purposes of modern buildings appears to me as absurd as to deny all power of expression to the art. The characters of sublimity, majesty, grandeur, gaiety, or gloom, may be and frequently are imparted to a structure by the skill of its designer; but this is very different from the building indicating the intended purpose of its erection. We may see this by considering that gloom and solemnity are features equally characteristic of a prison or of a tomb, that grandeur and majesty are qualities of expression as appropriate in a palace as in a senate house, whilst gaiety and elegance are generally considered as characters equally to be impressed on the decorations of the private house and of the theatre. A great number of buildings must, indeed,

always share in the same external style and expression, though erected for and adapted to very different purposes. We might as well expect the face of each individual whom we meet to express his particular pursuit and profession, and lay open to us his thoughts and intentions, as to look upon the façade of a building as the index of the purposes for which it was erected. The human face, indeed, is considered, and with unquestionable propriety considered as the index of the soul, as the outward sign by which we may read the feelings of the man, and being accustomed from the dawn of reason, perhaps intuitively, perhaps from experience acquired in infancy, to consider the features as indicative of the various passions, and our more mature years confirming this experience, we become so firmly convinced of the truth of these principles as to rely on the inferences we draw from them; and believing all men subject to the same feelings, the same joys and sorrows as ourselves, we make no distinction in our application of them; but consider, that whatever may be a man's rank, his race, his sation, or his name, without regard to climate or complexion, whether he be an inhabitant of the polar circles, or the t rid zone, we may read in his face the passions of his soul. But though he may thus plainly and universally read the feelings of the man, the cause of those feelings is yet hidden from us; and although the expression of the features we look upon may induce in us corresponding emotions, we are unable to divine its origin. We may thus see the emotions of joy or fear spread rapidly through a crowd ignorant of their cause; each individual being immediately affected by his neighbour's animated look and gesture, or though himself remote from danger, becoming at once alarmed by the fear expressed in surrounding faces, which indicate that something unknown is to be dreaded, by its portentous indistinctness, rendered yet more fearful. In the arts of painting and sculpture, the artist copying the human face and figure, gives to his productions the expression he may choose, and in proportion to the intensity of that expression is the emotion raised, but the cause of such expression is sought for in the accessories, or combinations of the piece; and our experience of human feelings leads us to judge whether the passion expressed is in accordance with its exciting cause. If then in these most expressive arts the feelings excited do not lead us to the reason which induced the artist to give such particular expression to his work, if we are liable to be deceived in interpreting the meaning of allegorical painting and sculpture, how shall we in architecture, where neither nature nor experience teach us to decide, how shall we say what particular character shall indicate a particular building. We have here no standard of expression; the ideas of different nations on this subject are as various as their languages: and in examining the remains of ancient edifices, we do not decide upon the purposes for which they were built, from their architectural character, but the acccessories and combinations of their construction.

The Gothic style, which is by us considered as peculiarly characteristic of a church, would most assuredly not be viewed in the same light by an ancient Greek. One of our large churches, or cathedrals, would unquestionably produce emotion in the breast of any man who had a soul to feel; but this, I am persuaded, would arise from the grandeur of the structure, from the insignificance into which the spectator sinks while gazing through "the long drawn aisle," or looking up to the "arched and ponderous roof," and from the majestic evidence of superior constructive skill around him, and not from any feeling that such a style proclaimed, by its silent but unerring expression, that he was in the House of God. As on the human face we may read the feelings of the mind, may trace gaiety, gloom, resolution, or despair, so may we be impressed by the design of a building with the emotions corresponding to sublimity, grandeur, magnificence, or elegance; but as we cannot determine the cause of the passions expressed upon the human features, so we cannot impart to any structure, vary its character as we may, the power to express whether it be a temple, a palace, a senate-house or an exchange. And as mankind differ as to the expression proper to be given to a statue or a painting, so will they disagree as to the character proper for a building, nor can we hope that architecture shall speak in the same language to us all, until all shall not only have been educated alike but shall have acquired the same prejudices, habits, tastes, and feelings.

A. D.

THE VELOCITY OF WATER IN VERTICAL PIPES.

We have received a voluminous communication from Mr. Shuttleworth, purporting to be a reply to the notice in our December number, of his system of railway propulsion. The extreme length of his letter, which occupies thirty closely written pages, would be a total bar to its insertion, even were it an argumentative treatise instead of being almost entirely discursive. We have received from another correspondent, however, a communication on the same subject, deserving much more attention, in which the writer states argumentatively his objections to two of the positions introduced incidentally in the article on Mr. Shuttleworth's hydraulic railway. The question of the velocities acquired by water flowing down vertical pipes is, indeed, important and interesting; we shall therefore, after allowing our correspondent to speak for himself, pursue the inquiry, not only for the purpose of defending our previously expressed opinions, but with the view of arriving at some satisfactory conclusions on a subject that has given rise to much discussion, and respecting which, as it appears to us, very erroneous notions continue to be entertained.

The following is the letter to which we refer.

"*London, December* 21*st*, 1842.

"SIR—Agreeing with the writer of the remarks on Mr. Shuttleworth's Hydraulic Propulsion system, which appeared in your *Journal* of last month, that it is a pity to see so much talent, ingenuity, labour and expense lavished upon an invention evidently impracticable, I must at the same time call into question the reasoning by which the writer has arrived at this conclusion, or at least that part of it which relates to the flowing of water through a vertical pipe; I do so more particularly, as the subject is important, and, I believe, new: also because, from the editorial character of the article, it might mislead many of your readers. I shall endeavour to show that the writer has committed two important errors in the fifth paragraph of that article; first, in explaining the uniform flow of the water in the column, by the cohesive attraction of the particles of water. Secondly, in saying that this uniform velocity is *half* that due to the height of the column of water flowing through a *small* orifice, he appears to think that, supposing the height of the water constant, the issuing velocity diminishes as the aperture increases. Now, it is evident that such is not the case, as by increasing the diameter of the orifice, the friction of the sides decreases in a greater ratio than the area of the orifice increases. This is so evident, that I believe it requires no further explanation.

"Assuming the Irishman's privilege of going backwards, I shall first endeavour to demonstrate the second error, by proving the velocity of the issuing water (and therefore, as will be proved in the second part) of the whole column, to be expressed by the formula $℧\sqrt{x}$, where x expresses the height, modified by the resistance of the air and friction. The friction, however, may be omitted, as being very trifling in a vertical pipe, when compared with the retarding effect of the atmosphere.

"When the water first enters the pipe, there is a slight decrease of velocity, in consequence of the "*vena contracta*," which in all works on hydraulics, is generally allowed for, by changing the ℧ in the above formula to 5; it then assumes a vertical direction, its velocity increasing as the square root of the height, until the resistance of the air, increasing as the square of the velocity, becomes equal to the momentum of the water. An equilibrium then existing between the accelerating and retarding forces, the velocity would be uniform. As will be seen from the following equations, it would require an immense length of *vertical* pipe before this uniform velocity could be produced. Let v represent the velocity, x the height, s the specific

gravity of water expressed in pounds, and h the number by which you must divide the square of the velocity, in order to find the resistance of the air; it is generally taken as equal to 500 lb.

"You have then three equations and three unknown quantities.

1st. $s \times v = r$, resistance of the air at the moment of equilibrium.

2nd. $\frac{v}{h} = r$

3rd. $v^2 = 64\,x$ taking 8 as the multiplier.

$\therefore h^2s^2 = 64\,x$, from which x the height at which the equilibrium between the accelerating and retarding forces exists, would be found. As might be expected this number would be very great. The above equations are also useful in finding the velocity due to any given height when the water flows *directly* into the air, but in the case of the hydraulic railway, where the vertical pipe deflects into one horizontal, the velocity of the water issuing from the vertical pipe will be gradually diminished, in consequence of the friction of the *horizontal* pipe, and therefore the velocity of the *whole* column (as will be seen) will be reduced to that of the water issuing from the extremity of the horizontal pipe.

I shall next proceed to show that cohesion does not account for the uniform flow of the whole column so simply, and consequently not so well, as the pressure of the atmosphere on the surface of the water. For suppose that in some part of the passage of the water through the pipe, two consecutive portions separated, a vacuum would be formed between them, consequently the atmosphere would act as an accelerating force on the upper portion, and as a retarding force on the lower portion, and evidently would cause the junction of the two parts—the vacuum then ceasing, the whole column would move together. A familiar illustration of this explanation is afforded by the well-known experiment of half-a-crown, and a piece of paper of the same form placed at the back, falling together to the ground. It is not the action of gravity alone which makes them fall together, but the pressure of the atmosphere on the half-a-crown. It is, I believe, clear, if these results be correctly deduced from sound principles, that cohesion does not satisfactorily explain the uniform flow of the column of water, and certainly does not reduce the velocity by one half, and consequently demonstrates the errors of the fifth paragraph, alluded to at the commencement of this letter. Some curious results, explaining the uniform flow of the column, even in the case of the atmosphere not acting on the surface of the water, might be deduced from the above equations, by differentiating them.

"You would oblige me by inserting this letter.

"I remain, Sir,

"Your obedient servant,

"T. F——X."

Before we reply to the two points to which our correspondent particularly directs attention, we must correct a misapprehension he appears to have, respecting the statement of the diminution of velocity by increase of aperture. What we stated was, "that if the size of the aperture *approximate to that of the pipe*, the velocity will be diminished, and that if the aperture be of the same size as the pipe, so that the *whole column* must fall as rapidly as the issuing fluid, the velocity will be diminished one half, without making allowance for friction."

We never intended to assert, as our correspondent appears to imagine, that the velocity of water through a small aperture would be greater than through a large one, unless the aperture be increased so much as to bear a sensible proportion to the size of the containing vessel.

We shall reverse the order in which our correspondent has considered the subject, and direct attention in the first instance to the cause of the continuously equal flow of water down a vertical pipe, because the main question rests on the admitted uniform flow of the fluid. The initial and the final velocities being the same, there must, we contend, be a deviation in this case from the usual law that re- [illegible] portions velocities of falling bodies. With respect to the cause of this equal fall of water, the difference between us is rather a difference in form than in substance. Our correspondent admits that the flow is uniform, but he attributes it entirely to the pressure of the atmosphere; we attribute its immediate cause to the cohesion of the particles of the fluid, without which, the pressure of the atmosphere could have no effect. Were it not for the coherence of the particles of the water, they would immediately separate in falling, and the particles would fall independently and with different degrees of velocity. Their coherence prevents this. Each particle of water in the pipe coheres to the particle immediately above it, with sufficient force to overcome the minutely different degrees of gravitating momentum, due to the difference in their respective times of falling. The effect of this continuity of coherence, transmitted from particle to particle, is to form a running *rope of water* in the pipe. This rope of water, if we may be allowed the expression, being supposed of equal size throughout, must have an equal velocity in every part of its course; for as water is practically incompressible, a motion communicated to one part of the fluid in the pipe will be communicated to all other parts as effectually as if it were a solid moveable column. It is true that the pressure of the atmosphere tends materially to prevent the separation of the water flowing down a vertical pipe, in the manner stated by our correspondent; but were it not for the coherence of the fluid particles, the pressure of the atmosphere would have no effect. Small round shot, for example, would not fall down a vertical pipe in a continuous stream, but in separate particles, and with differing velocities. The experiment of the half-crown and piece of paper, adduced by our correspondent as an illustration of his explanation, is not, we conceive, applicable to the purpose. It is not the pressure of the atmosphere on the paper that causes it to fall in the same time as the half-crown, for it is well known, that in a vacuum, even a feather will fall to the ground as soon as a guinea. The cause of the paper falling through the air in the same time as the half-crown, must be attributed not to the pressure of the atmosphere, but to the avoidance of resistance from the air, in consequence of the paper following closely *in the wake* of the half-crown, which sustains all the resistance.

It will be a curious, and we believe a new point, to ascertain to what extent atmospheric pressure influences the flow of water down vertical pipes. Many of our readers may have noticed the force with which water in a reservoir is drawn into the orifice of a long vertical pipe as the fluid flows down. This force results from the weight of water in the pipe, and from the pressure of the atmosphere on the surface of the water in the reservoir; the one tending to separate the cohering column of fluid, and to produce a vacuum, the other pressing in the water to counteract this effort. If the hand be held on the orifice it is pressed against the aperture with a force corresponding, within certain limits, to the height of water in the pipe. Were the length of the pipe greater than 33 feet, so that the weight of water surpassed the pressure of the atmosphere, a Torricellian vacuum would be produced, between the surface of the water in the pipe and the hand, and the latter would be drawn, or forced, against the orifice with a pressure equal to that of the atmosphere. No additional length of pipe would then increase the pressure. The vacuous space between the hand and the water in the pipe would be increased, but the pressure would evidently remain the same. The inferences to be drawn from these premises, are—first, that the velocity of the flow increases with the length of the vertical pipe, until the column of water balances the pressure of the atmosphere; secondly, that when an equilibrium is established between the column of water and the pressure of the atmosphere, the maximum effect is produced, and no additional length of pipe will add to the velocity of the flow from the reservoir.

Having thus disposed of the first objection raised by our correspondent, we shall proceed to consider the point on which we more essentially differ. Our position is, that the velocity with which water issues from a vertical pipe is half the final velocity due to the height of

the column. Our correspondent disputes this position; but instead of adducing arguments to prove that it is an "important error," he takes for granted the very question in dispute, and thereupon founds a formula for determining another question, with which the present has no immediate connexion. We affirmed, that the velocity of water flowing through vertical pipes differs from the velocity of water issuing from an orifice, in the bottom of a large column of equal height; we stated, also, the cause of this difference, and its amount. Our correspondent, by way of refuting this opinion, *assumes that there is no difference;* and then proceeds, on the ordinary data for calculating the velocities of falling bodies, to estimate the height from which a body must fall, before an equilibrium is established between the accelerating force of gravitation and the resistance of the air. We shall not imitate this summary process of disposing of the subject in dispute, but shall endeavour to show that, according to the generally recognized laws of motion, the velocity of water issuing from a long vertical pipe, cannot be the velocity which is due to the height; and we shall then show the cause of this apparent deviation from the usual law.

In the first place, it must be borne in mind, that it is admitted, that a pipe having the same diameter throughout, continues full during the flow of water through it; therefore, as water is incompressible, the velocity of the water must be the same at the top of the pipe as at the bottom. Suppose the pipe to be 16 feet vertical, and to be covered with water just sufficiently to keep it constantly full. Then, as the velocity due to a height of 16 ft. is, in round numbers, 32 ft. per second, if the water issue from the pipe with that velocity, the same velocity must be communicated to the fluid in all parts of the pipe, as it forms part of the hypothesis that the velocity is uniform. We should, therefore, be obliged to assume the existence of some force, which could communicate to the water flowing into a tube from a state of rest, a velocity equal to that it would acquire after falling freely through 16 ft. It can scarcely be asserted, that the pressure of the atmosphere would communicate this additional velocity, for the upward pressure on the fluid at the bottom of the pipe must always counterbalance the downward pressure on the top; and were the pipe a very long one, the upward pressure would be the greater, owing to the increasing density of air at lower elevations. There is, indeed, no rationally conceivable force called into action but gravitation; and if the whole column of water instantly acquire a velocity, which is due only to a fall through its whole length, the force of gravitation must, in some unaccountable manner, be doubled; for the momentum of a column of water, moving with a uniform velocity of 32 feet per second, is equal to the mean momentum of the same weight, were its motion to increase progressively from a state of rest to a velocity of 64 feet. There is not, however, the slightest ground for assuming that the force of gravitation produces any such effect. The final velocity of a body falling freely through 16 feet is, within a fraction, 32 feet per second, the mean velocity of the fall will therefore be one half, or 16 feet per second; and that, we contend, is the velocity with which a continuous and equal column of water would fall through a vertical pipe 16 feet long; putting out of consideration the friction of the pipe and the resistance of the air. In the case of water issuing through an orifice, the velocity due to a height of 16 feet is 32 feet per second, when the areas of the column and of the orifice are greatly disproportioned; but it appears from the preceding reasoning, that *the whole column* of fluid would issue with only half that velocity, which was the point to be proved.

Having, therefore, shown that the conclusion at which we have arrived may be deduced as a necessary consequence of the continuous uniform flow of water in vertical pipes, we shall next proceed to consider the conditions of water when flowing down vertical pipes, and when issuing from an orifice; and we shall endeavour to arrive at the same conclusion by a different process of reasoning.

It was demonstrated by Daniel Bernoulli, that the impulse of a "vein" of fluid falling perpendicularly, is equal to the weight of a column whose base is the area of the vein, and whose height is twice the fall producing the velocity. For example; if v be taken as the final velocity of the efflux acquired by falling freely from a height h, then it is well known that a body falling with the final velocity, during the time of the fall, will pass through a space equal to $2h$, or twice the height. As the water commences and continues to flow through an orifice with the final velocity due to the height, the quantity of water falling through the aperture in a given time is double the quantity that would flow through it if the flow commenced with the initial velocity of a falling body, and progressively increased to its final velocity.

Bernoulli's hypothetical vein of fluid was without any tangible boundaries, and the particles of the fluid in the vein were supposed to be pressed against, and changing places with, all the other particles in the containing vessel. It is this transmission of the pressure through the fluid, that causes the difference between the imaginary vein of fluid and a real pipe passing from the orifice to the surface. When the communication between the orifice and all other parts of the vessel is free, the water near the orifice is forced out, not only by the weight of the particles immediately above it, but all the particles of fluid are pressing towards the aperture and contributing towards the effect. The space occupied by the particles of fluid forced through the aperture, is immediately filled by other particles sustaining equal pressure. The continuity and equality of the pressure are thus preserved, which consequently maintains an equal and continuous flow, the height of the fluid being supposed constant. The velocity at the first moment of efflux is the same as would be acquired by a body falling freely from the surface, because the whole gravitating effects of the perpendicular vein of fluid instantly act on the portion of water above the orifice, and this action is continued, because the pressure remains free and constant. When a vertical pipe passes from the orifice to the surface of the water, so as to exclude the action of the surrounding fluid, the conditions are essentially changed. Suppose such a pipe to be filled with water, the base of the vein of water within, *when at rest*, would sustain the same pressure as another equal area on the bottom of the vessel, the heights being equal. But as the force then acting on the lowest lamina of the fluid is produced solely by the pressure of the laminæ of fluid above, were the lowest one to separate from the upper by the impulse of this pressure, the force would instantly cease, for the lamina immediately above the lowest not being impelled with equal force, would not have the same velocity. The adhesion of the particles of water would, however, prevent the falling vein of fluid from being divided, because the difference of the force acting on one minute lamina, and that acting on the fluid particles immediately above, would not equal the cohesive attraction which holds them together. The vein of fluid would, therefore, cohere and fall through the vertical length of pipe as a solid mass. Again; as the upper part of the vertical vein of fluid in the pipe would be as free to move under the influence of gravitation, when the supporting base was removed, as the lower portions of the vein, and as the force would be exerted in the same time, the velocities they would respectively acquire, would be the same; and they would fall through equal spaces in equal times. The length of pipe we have assumed to be 16 feet, therefore, it would be emptied by the fall of water in one second, the final velocity on issuing from the pipe would be 32 feet per second, and the mean of the initial and final velocities would be 16 feet per second.

If we suppose the water just to cover the top of the pipe, so as to keep it constantly full, the flow of water would then, it is admitted, be uniform instead of being accelerated, as in the preceding illustration. The water at the lower portion of the pipe would be retarded in its fall, by the continuity of cohesion between the particles of the fluid in the falling vien; or, in other words, the velocity due to the

fall at the bottom of the pipe, would be diminished, and a greater velocity than is due to the fall, would be imparted to the fluid in the upper part of the pipe, to produce a mean velocity. The mean between the initial velocity and 32 is 16. Thus, in whatever mode the question is considered, we arrive at the same conclusion, that the velocity with which water issues from a vertical pipe, (not exceeding 33 feet in length,) is one-half the velocity due to the height of the column.

We trust we have proved, even to the satisfaction of our correspondent, that there are no errors in our reasoning on this subject; and that he was induced to think so, in one case by a misapprehension of our meaning, and in others by a hasty consideration of the main proposition: which appears, though in reality it does not, to deviate from the recognised laws of hydrodynamics. The theory of the flow of water through pipes well deserves a more full consideration than we have now time or space to bestow upon it, and to which we shall probably return.

JAMES NASMYTH'S PATENT DIRECT ACTION STEAM FORGE HAMMER.

The truly valuable qualities possessed by wrought iron as the material of all others the best adapted to withstand force, has rendered its use as a mechanical agent almost universal, so important are the purposes it serves in enabling man to combat with the elements, and as it were bend them to his will, that we may almost measure the progress of civilization in any nation by the quantity of that inestimable material they convert to their use; hence it is that Great Britain owes no small portion of her power, wealth, and mechanical supremacy to her superior knowledge of the use and capabilities of this the most serviceable of all substances.

National improvement is always indicated and accompanied by increased consumption (by reason of increased application) of wrought iron; by its use man first merges from the savage state, and by its extended employment the most civilized nations not only maintain, but advance in their improvement. It is, perhaps, unnecessary here to remark how entirely we are indebted to wrought iron for the services of the steam engine; and its innumerable progeny of happy results, to say nothing of railways and steam vessels, in the very hulls of which, as well as in other ships, it is rapidly manifesting its superiority over wood, and so giving to the world another magnificent evidence of its all but universality of application. Hence it is that few mechanical improvements are of more real importance than those which relate to the manufacture of wrought iron, not only in respect to its production in the first instance, but also to our increased facilities, and means of working it into such forms as may be rendered desirable and necessary.

By a property almost peculiar to wrought iron, namely its all but unmeltableness, its applications would have been very limited, by reason of the difficulty we should have experienced in fashioning it into any required form, but by another peculiarity, namely its capability of being welded, we have the loss of convenience arising from its unmeltableness *more* than made up to us, and where we add to this its extreme malleability, by which property and by the assistance of heat, it is capable of being forged into any required form, our command over it is only limited by our means of applying the requisite force, whether by compression, as in the case of the process of rolling, or by blows, as in the case of forging by the hammer; this latter process being by far the most important, not only in respect to its affording us the means of giving to masses of wrought iron the requisite shape and form, but also, when the process of hammering is carried on with due energy, *while the iron is at a welding heat*, the effect of such hammering is productive of a most important improvement in the quality of the iron, as regards its tenacity and consequent capability of resisting strains without the risk of fracture, this gain of strength arising from the more intimate contact or union brought about between the particles of the iron, by reason of the more perfect expulsion of all those impurities which otherwise, by separating the particles or fibres of the iron, so impair its strength. Hence we have one of the many important reasons why it is so desirable that we should have the means of hammering iron when at the proper welding heat, *with all due energy*, whatever be the size or form of the mass in question.

The great success which has attended the application of the steam engine in the case of steam ships, and in other instances, has produced a demand for enormous forgings of wrought iron, such as paddle shafts, cranks, &c. that no small difficulty is now felt in the execution of large parts of them, having attained to such a magnitude as to be all but beyond the power and capability of the largest forge hammers to execute them.

The approach of this point of ultimate capability has long been felt, not only by the vast difficulty and expence by the ordinary means, such enormous forgings being so frequently attended by the destruction of the machinery employed, but also by the frequent occurrence of unsoundness being the certain result of inadequate means, and the exceeding the limits and capabilities of the machinery hitherto employed for the purpose, arising from a defect inherent in the principle on which such machinery has been constructed, the evils of which have been rendered more and more apparent by every successive attempt to enlarge the apparatus, with a view to endeavour to enable it to cope with the increase in the magnitude of the forgings it was required to execute.

It was with the view to remove *those defects in the principle* on which such forge hammers were constructed, and to produce such a hammer as should, in the most simple manner, attain all that was desirable in our means of forging the very largest class of work, and that in a manner infinitely more convenient, perfect, and economical, that lede me to contrive my *direct action steam hammer*, which I shall now proceed to describe, and which has realized my most sanguine expectations of its advantages.

In order to give such of my readers as are not minutely acquainted with the subject, a more clear view of the advantages possessed by this direct action steam hammer over those of forge hammers of the ordinary construction, I must refer them to Fig. 1, which is intended to represent a forge hammer of the largest class, and generally arranged according to the most improved principle. According to the scale on which this sketch is made out, such a hammer would be fully what is called a seven ton hammer, and consequently adapted (so far as its principles of construction will permit) for the execution of the largest class of work.

One chief and universal feature in all such hammers, is, that the power which causes them to rise and fall, and so give out blows on the work on the anvil, consists of *rotary motion*, which originating in the *rectilinear* motion of the piston of the steam engine, is conveyed to the hammer by and through the medium of *revolving shafts*, wheels, &c., and finally reconverted into its original up and down motion by means of the cam wheel, marked D in the sketch; thus, by a very *roundabout* course we have brought our power back again into the form it first existed, namely, rectilinear motion, or as nearly so as the radial action of the hammer will permit. And what advantage have we obtained by causing our power to travel to its object by such a roundabout course? none that I ever could see; and as to the disadvantages, they are many and most serious. In the first place, there is great loss of power, on account of the very unfavourable manner in which the momentum of the fly-wheel on the cam shaft D communicates its motion to the helve of the hammer, by a jolting action most unfavourable to the economical communication of power; add to which the vast space of the forge shop, occupied by all the intermediate apparatus of a *complete* steam engine, with its requisite fly-wheels, shafts, beams, and *very costly foundations*, which, in order to endeavour to maintain the apparatus in due order, has to be made of more than ordinary substantiality; so much so that, to resist the destructive effect of the vibration given to the entire machinery by the action of the hammer, the foundations have to be made so solid

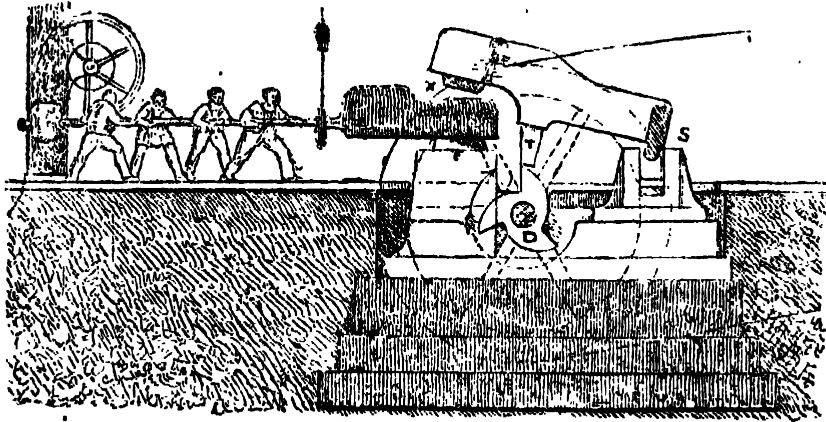


Fig. 1.—View of the Old Tilting Hammer.

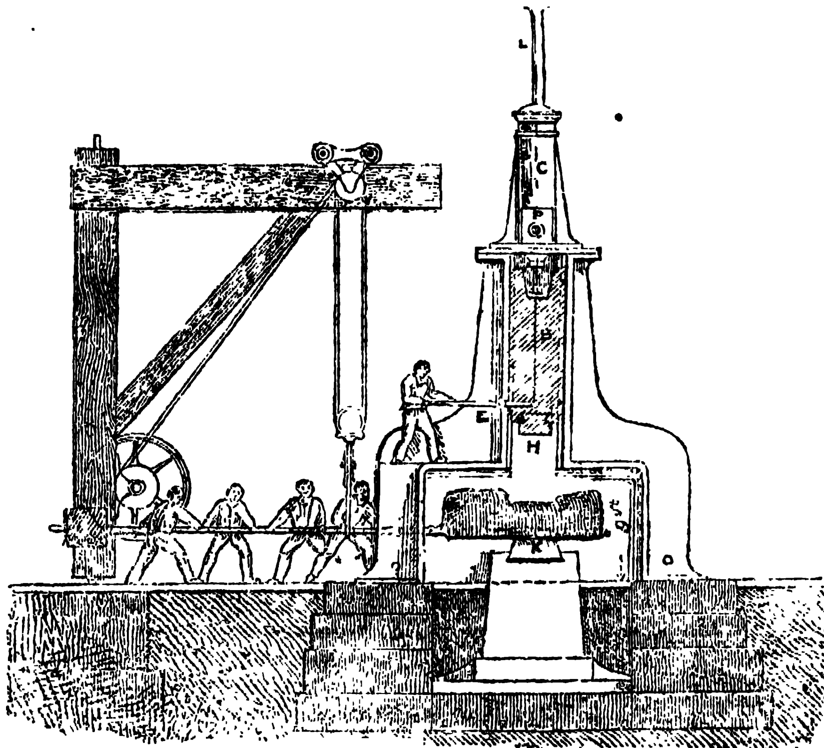


Fig. 2.—Nasmyth's Direct Action Steam Hammer.

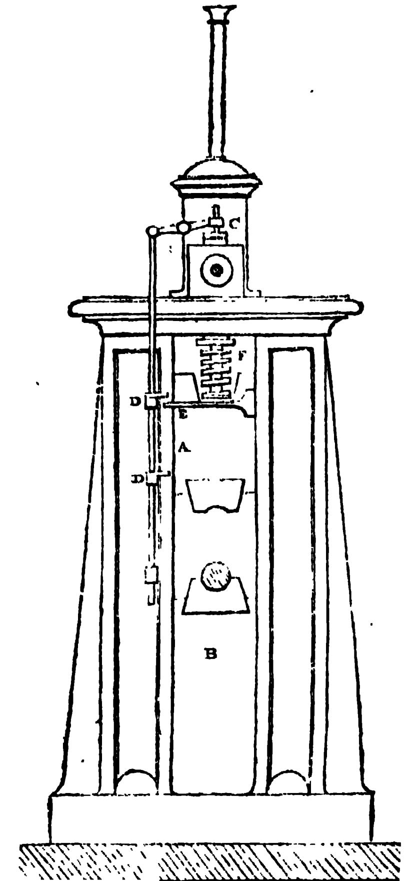


Fig. 5.—Self-acting

as to cost, in some cases, nearly as much as the whole metallic part of the apparatus.

With respect to the action of such a forge hammer, as seen in Fig. 1, it will be found that one grand defect in principle exists, namely, that when engaged in hammering a large piece of work, as that seen in the sketch, by reason of the work occupying the greater part of the clear space between the anvil face and that of the hammer, we have thereby a slight blow when we are doing a large piece of work, and a heavy blow when we are hammering a small or thinner piece of work, which is just the very reverse of what we could desire. And in the execution of large work this is found to be a most serious evil, in as much as, from the nature of the case, we would wish to have the most powerful and energetic blows that it is possible to command. The result of this is, that neither is the mass rendered so sound as we could desire, nor is it brought to its required form except by repeated heatings, at the very great sacrifice of time and iron, in so far as, ere the limited blows of the hammer have produced the required change of form, the welding heat has gone off, and all blows after this tend rather to loosen than compact or solidify the mass. Again, we have another very serious evil, namely, the very confined limits of the space between the hammer face at its highest, and that of the face of the anvil, which renders it quite incapable of admitting or operating upon a mass of any great breadth or height; and besides having the machinery of the hammer quite in the way, in many cases we have also this other disadvantage, namely, that except for one thickness of work, the hammer face and anvil are not parallel, as will be evident on referring to the sketch, and considering that the face of the hammer acts radial to the centre, S, Fig. 1, in which it rocks. This evil is to a small extent obviated, by means being given to raise up the tail or centre, S, but this process is not only difficult, but can only be done between the heats.

With a view to relieve all these defects, I have contrived my direct action steam hammer, which is represented in one of its many forms and applications in Fig. 2.

It consists simply of a cylinder C turned as it were upside down; that is, its piston rod comes out at the bottom of the cylinder instead of (as in most cases) out of the top; this cylinder is supported over the anvil K by two upright standards, O O, the end of the piston rod being attached to a block or mass of cast iron, B, guided in its descent by planed guides or ribs cast on the edge of each standard. This block of cast iron is the hammer or blow-giving part of the apparatus, while the cylinder, with its piston and piston rod, supplies in the most

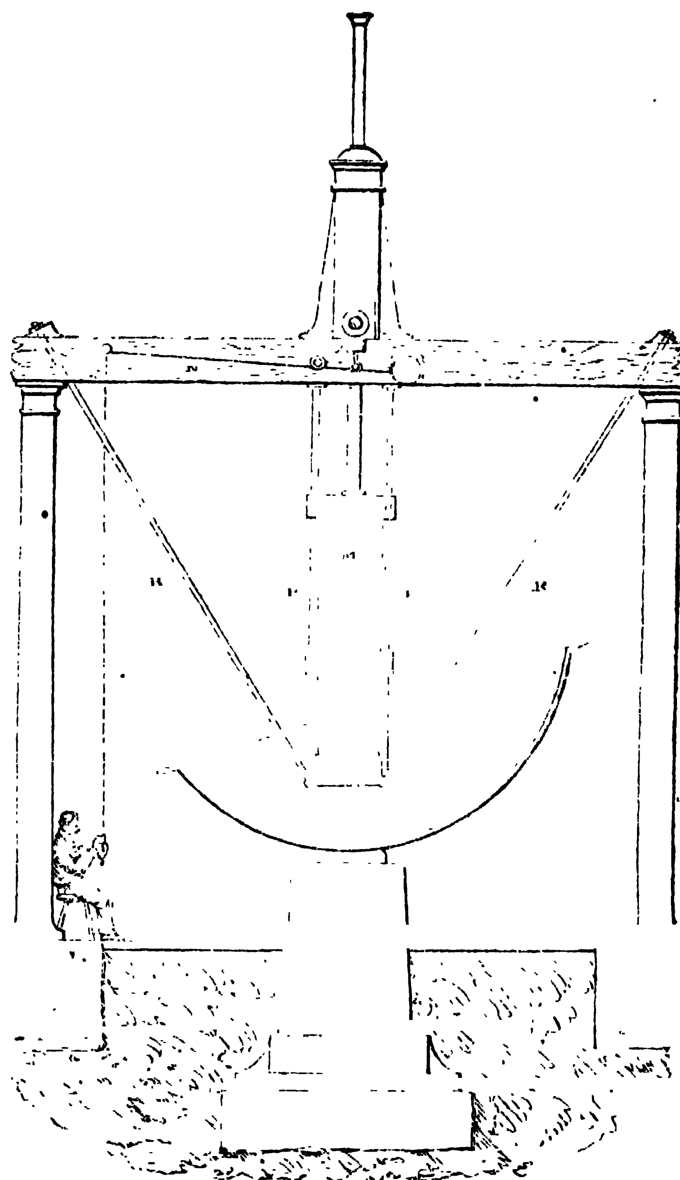
simple, straightforward, and direct manner, the power by which the striking block B is lifted, or raised up. *Gravity* performs the downward action for us in a most *direct* manner. In order to set this steam hammer in action, steam of such a pressure as, operating upon the underside of the piston, will a little [1] more than balance the weight of the block B, is conveyed from a suitable boiler, (situated in any convenient part of the premises,) through the pipe P into the valve box, in which a slide valve of the most simple form works. The valve being up, permits the steam to press upon the underside of the piston, and up goes the block B *to any height* (within the limits of the length of the cylinder) which the forge man may require. The handle E is now moved in the contrary direction, which not only prevents any further admission of steam, but also permits that which had entered, to escape by the pipe L; the instant this is done, the block B descends with all the energy and force due to its weight and the height through which it falls, and discharges *its full and entire* momentum upon the work then on the anvil, with such tremendous effect, as to set the blows of all previous hammers at utter defiance! In fact, the power of such a hammer is only limited by the size we please to make it, as *the principle* is capable of being carried out to any extent; whereas, in the case of such hammers as in Fig. 1, they have their limits, by reason of the very mass of material causing them to be weak *per se*, by the intestinal contraction of the iron which composes their mass, and which in their action is so destructive and trying to such a form; the consequence is they generally break over just behind the neck.

I have only alluded to the means which this steam hammer gives of obtaining tremendous blows. But energetic and powerful as it is, it is at the same time one of the most striking examples of the manageability of the power of steam; inasmuch as, when we desire to have *any variety* in the intensity of the blow, varying from the most gentle *nut*-cracking tap! to the most awful smash, we have simply to work the valve handle in proportion, and by so regulating the *exit* of the steam we can let down the block, like closing a well hung window, or *arrest its downward progress in an instant at any part of its stroke*, and retain it there at any required height at any required time; on the other hand, by duly regulating the entrance of the steam, we can lift the block to any required height, from the face of the anvil or surface of the work, and so regulate the amount or rapidity of the blows accordingly.

The form and arrangement of the steam hammer, as given in Fig. 2, is such as present experience shows to be most convenient, according to the scale on which the sketch is made out, the distance between the standards O O gives a clear space of 12 feet, namely, six feet on each side of the centre of the anvil, and six feet height clear over head, as figured in the sketch. But these proportions may of course be varied at will, as the *principle* of this steam hammer affords every facility to extention or otherwise. The space on each side of the anvil, in front and behind, being quite clear of all machinery, gives every facility to the introduction and management of the work, when we progress, as will be evident and fully appreciated by practical men.

The comparatively small space which the entire apparatus of the steam hammer occupies, may be judged of by a glance at the sketch, Fig. 2, as compared with that of the ordinary construction in Fig. 1. Had I turned the standards in the sketch, Fig. 2, so as to give a *side* or edge view, the contrast in respect to space occupied would have been much more striking. As regards the comparative original cost, any one the least accustomed to such matters will at once see the vast advantage in that respect in favour of the steam hammer, to say nothing of its vast superiority as to efficiency and little liability to derangement: In fact, so simple is it, that there is scarcely anything to go wrong. One great source of its durability in this respect is the manner in which the mass of the block is raised, namely, through the medium of the most elastic of all bodies—steam; which, in place of

Fig. 4.



any destructive jerk, as in the case of motion conveyed by impulse through solid media, so apparent and destructive in its effect in the case of the apparatus of the ordinary forge hammer, with the steam hammer the lifting motion is performed so smoothly as to be absolutely silent in its action, as if the great block had forgot, for the while, that it had any weight at all. I do not intend here to rival the celebrated Caterfelto by wondering at my own wonders! but truly the action of this simple but most powerful machine, is not a little striking, both in its action as well as effect. I think experience will prove that I am not too far yielding to sanguine expectations when I state, that the vast facilities which this invention gives to the treatment of large masses of wrought iron, will introduce quite a new era in the manufacture and working of wrought iron. We have now, by means of this steam hammer, a power and capability of producing forgings of wrought iron of *any* dimensions, whose soundness will give the best evidence of the value of the invention in that respect, and from the vast facilities of executing the most ponderous and acquired forms the saving of time and finish which can be attained under such a hammer will also prove that a great step has been made in the mechanical arts. In conclusion, it may perhaps be as well to remark on the valuable and important influence which such

[1] About five to six per cent more pressure than will just balance the block gives all due activity to the upward or lifting action of the block.

a hammer will have upon the quality of iron, as in the case of boiler plates and such like, the quality of which, as regards *soundness*, entirely depends on the efficient manner in which they have been hammered and consolidated in the primary process of faggoting or shingling, namely, the forming into one perfectly *solid* mass, the block of iron from which such boiler plates, &c. are rolled. Nine tenths of the defects which are met with in boiler plates, and which have caused such disastrous results, namely, defects from blisters, have arisen or may be traced to imperfect consolidation resulting from inadequate means of hammering the original mass into a truly solid block, by our having the *power* to force out all the scoria, which, otherwise lodging between the pile of pieces of which the faggot is composed, gives rise to the most serious defects, which every practical man has had to deplore. It will, in like manner, be scarcely requisite that I state any of the advantages that will arise in our having, by means of the energetic action of the steam hammer, a perfect security against unsound *anchors*, the importance of which requires no words to set forth. In short, we have now at command an almost new power, inasmuch as, by means of this steam hammer, we have an accession to our means of dealing with power in the form and state of *percussion*, such as has never been attained before, and that in the most *simple*, straightforward, and *effective* manner.

Fig. 3 shows the application of the hammer A for forging an iron shaft laid over the anvil or block B, and is made self-acting, as will be seen by a reference to the cut, that when the tappets D D come in contact with the pin or spring on the block E, the steam valve C is opened or closed.

Fig. 1 shows the application of the steam hammer for coppers, pans, &c. The hammer M works in the guides P P, suspended by the rods R to the beam above, like an inverted truss: the action of the man pulling down the lever N opens the valve, so as to admit the steam for raising the piston and with it the hammer.

I may remark, that one boiler can be made to work any number of steam hammers, as the steam has only to be conducted to each by pipes, and the power let on and shut off in the same manner as gas; and in most iron forges, the waste heat of the furnace will more than furnish the requisite steam. There are many other applications and details connected with this important invention, but reluctance to further trespass on your readers' attention, and the space of your columns, causes me to defer to a future opportunity.

But I trust the high importance of the subject will plead my excuse for the length I have allowed my remarks to extend to.

With most sincere respect,
I am, very truly yours,
JAMES NASMYTH.

Bridgewater Foundry, Patercroft.—Jan. 17.

OBSTRUCTION TO WINDOWS.

SIR—Your Old Subscriber at West Derby does not, I think, quite understand the nature of a right gained by prescription to a window overlooking a neighbours' land. In the case put by him, the right is not, as I conceive, so much to the *window* as to an *easement of light and air* through the window, and consequently "much (query, all) must depend upon the hard swearing of witnesses on both sides, as to whether a building erected near a window does or does not obstruct the light and free circulation of air." Indeed I doubt very much whether proof that a building had been erected within two feet of the window would be proper evidence to rely upon, unless it were also proved that the said building had prevented a certain quantity of light and air from finding its way to the window. With regard to question 3, it is obvious that the right being to *light and air*, and not to *space*, a building may be erected as high as the *upper side* (beyond the limits of the building act) of the window sill, it being impossible that such an erection should obstruct the free passage of either to the window.

6th January, 1843.

I am, Sir,
Yours very obediently,
R. R. A.

ON THE SEWERS OF THE METROPOLIS.

1. *Report to the Secretary of State from the Poor Law Commissioners on an Inquiry into the Sanitary Condition of the Labouring Population of Great Britain.*

2. *Address on the above Report in reference to those parts which inculpate the Metropolitan Commissioners of Sewers, delivered at a Meeting of the Court of Sewers for Westminster, &c.* By the Chairman, THOMAS LEVERTON DONALDSON, Esq.

WE are heartily glad that the subject of the sewers of the metropolis is likely to become an object of inquiry by the administrative authorities, a course for which we have long been anxious. In consequence of a voluminous report by Mr. Chadwick, the secretary of the Poor Law Commissioners, containing many very stringent remarks on the drainage of the metropolis, the ire of many of the functionaries has been excited. It is very evident that there must be something radically wrong in the management, when we find such vast sums of money yearly raised in the metropolis under the name of sewer rates, while the extension of sewage is so very slow. It will be our endeavour to show, without entering upon all the points in dispute, that the present laws and system of building sewers are most oppressive and expensive to builders, and consequently the important system of draining house by sewers is avoided, and instead thereof, cesspools are resorted to, and every scheme which can be thought of to save the expense of building a sewer. Under such circumstances, we are sorry that Mr. Donaldson, for whom we have great respect, should have betrayed himself so far as to become the champion of the present system. The report of Mr. Chadwick, indeed, like the apple of discord, seems to have been productive of much asperity and bitterness of feeling.

Our present object will be to prove that some broad and general measure must be at once adopted for the regulation of the sewage of the metropolis, and that all petty legislation on the subject of drainage should be suspended. We must not have the metropolis split into half a dozen commissions. Now that the subject is fairly opened, we do sincerely hope that the Secretary of State will not listen to the resolution passed at the court of commissioners for Westminster sewers on the 13th ultimo.

"That the Court requests an investigation under the authority of Her Majesty's Secretary of State for the Home Department into the charges brought against the Westminster Commissions of Sewers in the report of the Poor Law Commissioners on the sanitary condition of the poorer classes, and to ascertain the best means of cleansing the streets and roads by aid of sewers, and also the most advantageous form of sewers for the public interests."

This is giving the real matter at issue the go by, we want not the isolated works of the Westminster Commissioners, but what we do want is an examination into all the metropolitan commissioners, to see whether they cannot be advantageously consolidated into one body. We have now on the northern side of the river Thames, the City, the Westminster, the Holborn and Finsbury, the Regent Street, the Tower Hamlets, and the Stebon Heath Commissions; here we have six different commissions, and it is consequently impossible to lay down any one system of drainage for the whole metropolis; for to do so it is requisite to have the consent of all the different commissions, which would require months to obtain, even supposing it possible that they should all agree. We have running right through the very centre of the Westminster sewage, a sewer of a large class, and at considerable depth, constructed about 25 to 30 years since, belonging to the crown, and capable of draining an immense district; yet this sewer cannot be touched by the Westminster Commissioners; then again we have, as Mr. Donaldson tells us, in his report, the Westminster sewers running from the Thames up Tottenham Court Road, to the New Road, then the Holborn and Finsbury Sewage commences, and after the sewer passes through the latter district, it comes to the county drainage, so that any improvement in the drainage of the up-

lands of the county could not be made without first, the Westminster Commissioners constructing a new sewer, or lowering an old one, then the Holborn and Finsbury doing the same. So, also, if either commissions wished to divert the upland waters, by constructing catch water drains, so as to prevent too great a flow down any particular district, and prevent the lower parts of the metropolis from being inundated, it cannot be done, and the consequence is, that each commission is obliged to cut about and alter the old sewers, to get rid of the evil in the best way they can.

Mr. Donaldson tells us that

"During the present century, and particularly since the removal of old London Bridge, every opportunity has been taken to lower the outlets. For instance, the Essex Street sewer, between 1816 and 1836, has been lowered from its outfall at the Thames to near Great Russell Street. Bloomsbury, in length 5,800 feet. The eastern branch of the Hartshorn Lane Sewer, between 1831 and 1839, from Long Acre to the New Road, by the line of Tottenham Court Road, &c., in length 4,200 feet. Another branch of the Hartshorn Lane sewer, between 1820 and 1837, from the south end of the Haymarket to Oxford Street, by the line of Princes Street, Wardour Street. &c., in length 3400 feet. The whole of the King Street sewer, between 1830 and 1832, from Westminster Bridge to St. James's Park, 1200 feet. The Wood Street sewer, between 1824 and 1827, the College Street sewer, between 1824 and 1832, and the Romney Row or Horseferry Road sewers, in 1840, have been lowered and rebuilt of enlarged dimensions from their outlets for their whole extent, being a length of 6850 feet, presenting in these lines alone a total of *only* 21,450 feet."

Here, then, we have a fearful summary of expenses incurred in *lowering* the old sewage only, and we think an inquiry might be usefully directed to see if all the commissions had been united, whether it would not have been far cheaper and more effective to run new lines of sewer from the river Thames through districts which had no sewers and to have joined the old sewage at some distant point, and thereby have relieved the old sewers in the lower levels.

By this arrangement, we should have had the old sewers still remaining, which might have answered the purposes of draining either high or low lands, and have obtained an immense additional length of new sewerage at the same expense. We do not mean to say that in all cases under the present system of separate commissions, this could have been effected; but it is a fair subject for enquiry, and can only be got at, by having a thorough examination of all the plans and levels of the present sewerage, in every district, connected with the metropolis.

Mr. Donaldson subsequently calls our attention to the vast works that have been executed for the improvement of the King's Scholar's Pond Sewer; let us give his own words.

"But the greatest work ever executed by this or any other commission has been that effected on the *King's Scholar Pond Sewer*, which has been wholly rebuilt for an extent of upwards of three miles, from the River Side to the Regent's Park within the last 24 years. It has been so vastly deepened and enlarged since the year 1816, that property of the most valuable description, in the neighbourhood of the sewer, at Pimlico, including Buckingham Palace, the lower floors of which are below the highest tide level, and most of the streets adjacent to the sewer between Piccadilly and the Regent's Park, have been benefitted to an incalculable extent. Formerly the whole neighbourhood was inundated by every sudden fall of rain, so that many of the houses in Berkeley Square, Bruton Street, Avery Row, South Molton Street, Wigmore Street, South Street, Baker Street, and Spring Street, were greatly depreciated in value; and some houses in Berkeley Street and Bruton Street remained unoccupied for many months together, in consequence of the well-known fact, that in the summer months those premises were subject to have their lower floors burst up during thunder storms, and the water to rise so as to extinguish the kitchen fires, &c.

"One of the great means for remedying these evils was designed and carried into effect by Mr. Dowley. I especially allude to the entire removal of two immense stone piers, which had at some former time been built in the water way of the sewer, and which piers supported certain parts of the heavy and lofty walls of the houses in Grafton Street, St. George's. These piers, one measuring 53 feet in length, the other of a more square form, whereby the water way was divided into two channels, were formerly considered advantageous to the property lower down the line of sewer, by penning back the torrent of water in times of storms. The work of taking out these obstructions as also removing two great projections, and putting in an inverted arch throughout the whole length of sewer between Hay Hill and Bruton Street, in length 550 feet, at a greatly increased depth, was performed from within-side the sewer, which had its course under buildings. These works proved of such vast importance to the sewage of the district, that what was formerly reported to be impracticable by several eminent engineers, amongst whom were the late Mr. John Rennie, Mr. Jessop, Mr. Chapman, Mr. Bevan of Leighton Buzzard, and others, was actually and substantially carried out, and was afterwards inspected by some of these gentlemen, as also by a numerous committee of the commissioners, who not only approved of the work that had been so done, unseen by any one other than by the workmen employed, but were somewhat surprised that so bold an attempt had been successfully accomplished.

"In the prosecution of the operations necessary for reconstructing *this one line of sewer*, various instances may be cited to show that, at all events, the management and execution were entrusted to an officer of this court who knew something of his profession, and to any one, who is acquainted with that part of the district lying between Piccadilly and Oxford Street, it must be manifest, that cases requiring ability, foresight, science and practical experience frequently arose. I mean such difficult cases as passing a sewer seven feet six inches wide in the clear with side walls two bricks thick, at a depth of 22 feet and upwards, along White Horse Street, Piccadilly, a street only 20 feet wide. Again, carrying the same sewer through Sun Court, Curzon Street, which is less in width than that of the external dimensions of the sewer itself. And, further on, this sewer winds its course under and close to buildings of great magnitude, nearly the whole way from the lower end of Berkeley Square to Oxford Street and in most instances at a depth of from 10 to 12 feet *below the foundations of the contiguous buildings*. Surely, these were works, which, by their nature and extent might be considered of a scientific and high order of civil engineering, and such as have only been approached by some recent works, perhaps, of the city commission of sewers."

With all due deference to the talents of Mr. Donaldson, we are inclined to doubt the latter part of his statement, that these works "might be considered of a scientific and high order of civil engineering." Instead of enlarging this sewer, and rebuilding it, with all its original sinuosity, the course we should have preferred, would have been to have run a new sewer from where the Scholar's Pond sewer crosses in Oxford Street, near South Molton Street, along Oxford Street, and united it with the Regent Street sewer belonging to the crown. No doubt we shall be told, this could not be done, as the Westminster Commissioners have no power to enter the Regent Street sewer, this then would at once have proved the great necessity of uniting the several commissions; now, if this plan could have been adopted, it would have relieved the large pressure of water flowing down the sewer, and inundating the houses as represented in Mr. Donaldson's report, and would have saved the great expense incurred in removing the large piers under the houses in Grafton Street, and rebuilding the tortuous part of the sewer in the vicinity of Curzon Street; and another advantage gained, would have been in giving Oxford Street a sewer, which had none. Similar relief might have been given to other portions of the large sewers which were overpowered with the upland water, and new sewers given to such portions as had none before; for instance, another sewer might have been constructed, to have commenced about Berkeley Street, and run along Piccadilly, and discharged itself into the Regent Street sewer, near the Quadrant, connecting with it the sewers of the side streets, which would have relived the Scholar's Pond Sewer and have given Piccadilly a sewer which it was deficient of until lately. And again, the sewer of Pall Mall might have been diverted into the Regent Street sewer, although it comes to within a few yards of it the sewage is carried into the Scholar's Pond Sewer, and has to travel a distance of a mile and a half before it discharges itself into the Thames, whereas, if the former plan had been adopted, the discharge into the Thames would have been within half a mile. If these collateral sewers had been built, the vast sums of money in reconstructing a considerable portion of the Scholar's Pond Sewer, and building the large approaches described in Mr. Donaldson's address, might have been saved

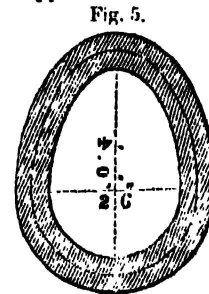
and part of the cost devoted to the new sewers we have described. We think that we could point out several other improvements that might have been adopted, if the commissions had been united; but we have already trespassed beyond our original intention upon this portion of the subject, and must now turn our attention to the more important part respecting the form, construction, and expense of the present sewers of the Westminster Holborn, and Finsbury, and Regent Street commissions.

We will first proceed to enquire into the present cost of constructing sewers, and see how far they might be modified, so as to induce builders of small tenements to construct sewers, in preference to cespools; in order to do this, we are at once brought to another bone of contention between the present combatants; one commission contends that the oval sewer is the best form, whilst another flatly contradicts it, and says that sewers with upright sides are the best; we must therefore first hear what Mr. Donaldson says upon the subject.

"With respect to the form of section of sewers, our commissioners have very wisely adhered to that, which experience has proved to them to be substantial and best calculated for the purpose. We are to recollect that under-ground constructions must be built so as to last for ages, otherwise a continued re-building of sewers causes a constant breaking up of the streets, and obstructions to thoroughfares, and a suspension to a certain degree of the commerce of the trades-people on the line. The sewers must be large enough not merely for the ordinary service of relieving soil drainage, but also for carrying off the torrents of water, which fall during violent storms. Hence a large capacity must be given them. Again, this large dimension is not without a further use in enabling the officers and workman to inspect and repair them with sufficient facility, the width even of our second sized sewers enabling two workmen to pass each other. As regards the upward sides of the sewer, it must be borne in mind that all circular work constructed of brick can only be formed by making the joints more open at the extrados than at the intrados, for the square shape of the brick does not lend itself to other than rectangular construction. Now these open joints are filled with mortar in a moist state, and before it is set, the earth to the depth of several feet is filled in, the centres are struck, and the consequence is an irregular settlement of the whole work; whereas with spreading footings, an invert at bottom, a circular arch at top, and upright side walls, most of these inconveniences are avoided, and the sewer, even if the earth be washed away at the top or sides, as sometimes happens from the bursting of one of the large main pipes of the water companies, stands upright and alone on its board base, whereas the oval sewer must have inevitably fallen over. I may also add two other important reasons for giving as much square construction as possible to the body of the sewer, and these are, greater security against imperfect workmanship, and detection of false thicknesses of work at sides. Besides, in the event of its being judged expedient to increase the depth of a sewer by putting in a new bottom by underpinning, this operation becomes comparatively easy with upright side walls—almost impracticable when they are curved. Much stress is laid in the report upon the curved side walls as materially aiding the rapidity of the current. But, in fact, the ordinary sewage *rarely rises above the invert*, and when it does, there is such a force in the volume of water, that no perceptible obstruction is offered by the absence of the complete circular form."

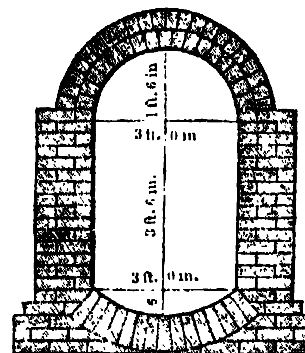
If, on comparing the sewers of the Westminster Commissioners, Fig.1 and 2, with those of the Holborn and Finsbury Commissioners, Fig. 2 and 3, it must be seen that Mr. Donaldson's remarks about circular work are completely futile, for his objections apply equally to the arch and invert of the Westminster as they do to the Holborn and Finsbury; and as to the sides, the radiating of the courses in the oval form is so trifling, that it is not worth naming. And again, can Mr. Donaldson tell us if such an accident ever occurred, as the bursting of a main pipe, and of washing away the earth to the extent of endangering an oval sewer. We have frequently heard, that during the construction of the upright sewers, of their falling in [1], but never heard of such a case with the oval sewer. 20 years ago, we happen to have been engaged in the construction of about 1000 feet of sewage of the oval form, as shown in Fig. 5, built upon the crown lands in the vicinity of Regent's Park, and up to the present time we have never heard of a single failure, either during the construction or since; we think this fully justifies us in pronouncing that the oval form is most effective, and in point of expense infinitely to be preferred. Now let us compare the expense of both forms, we will take the cost of the materials and labour the same in both cases, 1s. per foot reduced, or 13*l.* 12s. per rod of brickwork, and 1s. per cubic yard for digging, strutting, and filling in or removing the surplus ground, the top of the sewer being taken as 6 feet below the surface of the ground.

Fig. 5.



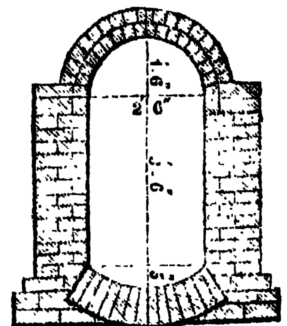
WESTMINSTER SEWERS.

Fig. 1. first class.



	s.	d.
17 feet brickwork - -	17	0
3½ yards digging	3	4
	20	4

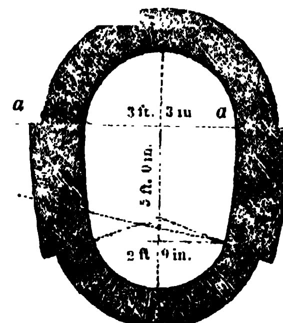
Fig. 2. second class.



	s.	d.
15 feet brickwork - -	15	0
3 yards digging - -	3	0
	18	0

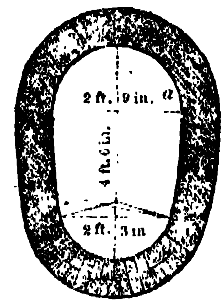
HOLBORN AND FINSBURY SEWERS.

Fig. 3. first class.



12 feet brickwork - -	12	0
3 yards digging - -	3	0
	15	0

Fig. 4, second class.



9 feet brickwork - -	9	0
2¼ yards digging - -	2	4
	11	4

Fig. 5,[2] the Regent Commission sewer is built in two half brick rims, and contains about the same quantity of brickwork as fig. 4, and may be taken at the same cost. Thus it will be seen that in adopting the oval form, there is a saving of 5s. 4*d.* per ft. in the first-class sewer, and 6s. 8*d.* per foot in the second-class sewer. Can there then be, after perusing the above calculations, a doubt as to which form of

[1] We could find several cases of the Westminster sewers falling in during their construction, and the upright sides bulging in, as at Notting Hill, and also in the vicinity of the King's Road, Chelsea. But we are told by the worthy chairman, that they were built by private individuals, and not by the commission. Let us ask Mr. Donaldson, under whose direction and superintendance are they built? Dare a builder alter the form, or lay a brick contrary to the directions of the commissioners' surveyor; if this be the case, the commissioners are responsible for the work and the form of the sewer, and not the builder.

[2] We give the preference to the oval sewer, Fig. 5, over that of Fig 4, as the larger part of the oval is downwards, which allows a greater flow of water to pass off quicker; we also consider that the extra half-brick thickness of the sides of Fig. 3, oval sewer, perfectly useless, and might with safety be omitted, which would reduce the cost of the sewer, 1s. 8*d.* per foot.

sewer the preference ought to be given? then why oppress the builder by compelling him to construct such expensive sewers as the Westminster Commissioners require? Why not, as we said before, give some encouragement? Nay, we would create every inducement to the builder of small tenements to construct sewers, and we feel assured that if the expense of building sewers could be reduced to 10s. per foot, making the charge for small houses of 15 feet frontage on *each side* of the sewer under FOUR POUNDS, that every builder would adopt sewers in preference to building cesspools, as the difference in expense would then be so trifling; but on behalf of the builder, we contend for a still smaller form of sewer than even the second size oval sewer, for in many cases where the distance required to be drained is not above 200 feet from a main sewer, with a good fall, we would allow an oval drain of half the altitude and breadth of fig. 5, to be constructed with a half-brick rim, or an 18 inch barrel drain, with manholes every 50 feet; the expense of such drains would be 2*l.* 5s. for houses on each side of the drain for the 18 inch barrel drain, and 1*l.* 10s. for the small oval form; this form of drain, is amply large enough for 25 to 30 small tenements, including the surface drainage; therefore, why put the builder of small tenements to the vast expense of erecting "second-size sewers, enabling two workmen to pass each other," when "the ordinary sewage rarely rises above the invert," for which the Westminster Commissioners charge 10s. per foot for houses on each side, or 7*l.* 10s. for a fourth-rate house.

We have dwelt more particularly upon sewers for small houses, as it is to these houses that a cheap form of sewage is wanted, for the expenses attending upon sewers, forming roads, paths, paying fees to district and paving surveyors, leases, and a variety of other incidental charges, which do not immediately belong to the construction of the house, fall almost equally the same on the small as on the large house, and raise the cost of the latter so enormously, that much higher rents are obliged to be obtained from the small tradesmen and operatives than would otherwise be required if these charges could be reduced. We could give an instance at the present moment, where parties who have built some fourth-rate houses immediately contiguous to a main sewer of the Westminster Commission, will not incur the expense of the sewage by paying 10s. per foot, but prefer constructing cesspools.

It will be a question well worthy of inquiry to ascertain what number of houses there are on each side of any of the sewers that have been built or rebuilt by the Westminster Commission, and see how many of those houses have taken advantage of the sewers. We are fearful the return would show very few. If this be the case, it will be the best proof that the enormity of the charge of 10s. per foot demanded by the commissioners, is of an oppressive nature, and if they continue to make this demand, we are fearful that very few houses in poor neighbourhoods will ever have drains to enter the sewers, and that all the calamities pictured in the report on the sanitary condition of the poor, will still rage with fearful violence. It is not for surface drainage that new sewers are so much wanted as to get rid of the nuisance of building cesspools under the basement, and in the close and confined yards at the backs of the small houses.

We cannot allow these observations to close, without offering a few remarks on the regulation for constructing drains. We believe all the Commissions compel each house to have separate drains, no matter how far the house may be from the centre of the sewer. We recollect, a few years since, seeing the ground opened to the distance of at least 60 feet long, and 10 feet deep, opposite to every house in the Grand Junction Road, Paddington. Now, if the commissioners would have allowed a 15-inch drain to have been constructed from the sewer for every three houses opposite the centre house, with a branch drain, nine inches clear, at the end next the houses, there would have been a saving of 100 feet run of digging and making good roads, and a drainage equally as effective, if not more so; for it is not so likely that the single 15 inch drain would have got choked as the three 9 inch drains. And again, why not allow a 12 inch drain to be constructed opposite the party wall, between two houses, for the drainage of the two, some compulsory law might be made for compelling both owners, if there should be two, to contribute their share to the repair or cleansing the drain, if it were required. By some modification of this nature, a vast expense would be saved both to builders and owners of houses, as the principal expense in carrying a drain into the sewer is generally the opening of the ground and making good the roadway.

We have, in the present notice carefully abstained from entering into an examination of the Flushing apparatus, the feasibility of cleansing the streets by means of the sewers, and also the consideration of uniting the paving of the metropolis with the sewers under one commission, the same as is now done in the City of London, for all these points require to be gone into at considerable length at some future opportunity. We hope we have been successful in establishing that sewers may be constructed far more economically, and equally as effective, as the present form of the Westminster sewers, and that considerable improvements might have been adopted in rebuilding and relieving the old sewage, and at the same time increased to a large extent the sewage, without any additional expense, and if we have done so, satisfactorily, it then behoves us to press upon the government to take up the inquiry on a broad scale, employ competent parties to report upon the subject, and see how far a grand measure might be laid down for the improvement of the whole of the first metropolis in the world.

CONCRETE, ITS INTRODUCTION, COMPOSITION, USES, AND COMPARATIVE EXPENSE.

CONCRETE was first used in this country by Sir Robert Smirke, at the erection of the Penitentiary at Millbank, afterwards at the undersetting of the walls of the New Custom House, and has been generally used by the above named architect in the public buildings since erected under his care, especially at the club house of the Oxford and Cambridge University in Pall Mall, where the whole area of the building, and to the extent of two feet beyond the line of the lowest footing, was covered to a depth of 2½ feet, the depth being increased to 4 feet under all the walls that rise to the roof; in the specification of the last named building it is thus described. "For the grouted stratum clean river gravel is to be provided, and mixed with lime ground or pounded to a fine powder; it is to be well mixed with the gravel, twice turned over before it is wheeled to the excavation, and it is to be thrown from a height of not less than 6 feet in every part. A man to be kept treading down and puddling the mass as it is thrown down; the proportion of materials to be 6 parts of gravel to one of Dorking, Merstham, or Haling stone lime." It has now become, in the present day, the most favourable expedient resorted to for artificial foundations. Mr. Ranger, of Brighton, improved the above hint by using hot water to facilitate the setting, for which he took out a patent for making artificial stone. A detailed account of the application of Mr. Ranger's artificial stone to the building of docks and river walls at Chatham and Woolwich, is given in the 1st vol. of the *Journal*, being a paper by Lieut. Denison, from the Papers of the Corps of Royal Engineers. Analogous to concrete is beton, from which it differs, in broken stone being used instead of gravel, in the proportion of two of stone to one of lime or pozzolana of Italy, a description of which, taken from the *Franklin Journal*, appeared in Vol. 3, page 265, of your valuable periodical. Since the introduction of concrete, some little difference of opinion as to the proportions of materials and manner of mixing them has arisen among engineers. I therefore give the composition from several specifications:—No. 1. The concrete to consist of 5 parts of clean gravel, perfectly freed from loam or clay, with a proper proportion of small gravel and sand, as well as large, and one part of lime measured dry, the lime to be mixed into a perfectly smooth uniform paste, as for the mortar, but with more water, and then thoroughly mixed with the gravel.—No. 2. The concrete to be composed of sandy gravel and well burnt lime, in the proportion of 3 of the former to 1 of the latter. The gravel to be free from all earthy matter, and the pebbles not to exceed one inch in diameter.

The lime is to be used in a hot state when slacked, and to be immediately mixed, using no more water than is sufficient to incorporate them. After being twice turned, it is to be wheeled on to a stage 10 feet high, and let fall into the trench; it is not to be puddled or disturbed in any way until perfectly set.—No. 3. All concrete must be composed of gravel perfectly clean, and mixed with fresh well-burnt lime in the proportion of 6 of gravel to 1 of lime. The lime and gravel to be mixed in a dry state, and a sufficient quantity of water afterwards added.—No. 4. Concrete to be composed of good lime, gravel, and sand, in the proportion of $\frac{1}{7}$ to $\frac{1}{8}$ of lime, and it should be laid in about 12 inch layers or courses, and pitched from a height of 10 to 12 feet, neither should it be disturbed until properly concreted and set.

In the above five opinions, including that of Sir Robert Smirke, we have the relative proportions of gravel and lime, varying from 3 to 9; and No. 1 states the lime and water to be first mixed, in which No. 2 nearly coincides, whilst No. 3 insists on the gravel and lime being first mixed, and then the water added; Nos. 4 and 2 coincide that the concrete is not to be disturbed after it is thrown into the trench, whilst Sir Robert Smirke expressly states that parties are to be employed puddling the mass. The whole are agreed in specifying that the material is to be thrown from a height. From considerable practice and experience in the mixing of concrete, I think that the lime need not be ground, but simply mixed with the gravel, and then, by the addition of water, it will fall to an impalpable powder, also that it is unnecessary to be at the expense of puddling the mass after being deposited in the trenches, neither is there any advantage to be derived from discharging the mixture from a height, both of which operations increase the expense of the concrete, and as the concrete in the act of setting expands in bulk, I think that alone a sufficient proof of the inutility of both of the above mentioned operations, their tendency being to condense the mass, whilst its own natural tendency is to expand. With respect to the proportion of lime and gravel, I think the less lime the better will be the concrete, and that the proportion of 8 to 1 of lime is decidedly better than 3 of gravel to 1 of lime. As to the quality of materials employed, the lime must be stone lime, fresh from the kiln; that from chalk will not do, and hydraulic or lias lime is to be preferred to stone limes. With respect to gravel, if obtained from a pit, the ochereous or ferruginous is to be preferred, and if loam is present, so as to soil the hand, the gravel must be washed, if the gravel be obtained from rivers by dredging, alluvial and vegetable deposits are to be avoided; and if the gravel contain vegetable refuse, it must be screened or washed. Shelly sharp gravel is the best, the proportion of small or large pebbles, and the due quantity of sand, is soon learned with a little practice.

As to the uses of concrete, it is principally adopted as an artificial foundation, and from four to six feet is a sufficient depth, and extending two feet beyond the space to be occupied with the building. The following testimony of the utility of concrete, is from Weale's Bridges, page 31. "Piling will probably never be found more safe than a body of concrete; the latter cannot be too much esteemed, for its durable and almost imperishable nature, besides being quite as safe and, perhaps, more durable than piling;" and from the paper of Lieutenant Denison, before alluded to, we have the following ratification of its uses. "Concrete cannot be advantageously employed as a building material." "It may be employed with advantage in backing retaining walls." I. K. Brunel, Esq., C. E., has used concrete as a foundation, nearly exclusively and universally in the bridges on the Great Western Railway; and in the celebrated bridge of Maidenhead, the land arches are backed with concrete, to the depth of 10½ feet, and the abutments of the large arches are also backed with concrete. In culverts underneath embankments, the same able engineer has extensively used concrete as a backing material, the brickwork being kept thin, and then enveloped in a mass of concrete, in the form of a polygon, of six sides, or, of the form of two truncated cones, with their bases joined.

Concrete was used on the Great Western Railway, wherever it could be employed, as a backing material; its use is now rapidly extending to the provinces, and bids fair to supersede all other means now employed for making a foundation; it is much improved by being mixed with oxide of iron, smith's scales, and roasted iron stone, or any material containing iron. As regards the comparative expense, brickwork being the most common building material, has been taken as the standard of comparison with concrete for price, and its cost in most districts will be found from one-third to one-sixth the price of brickwork, taking a cubic yard as the quantity of each material, the latter will cost 5*s.* and the former 21*s*, both, to a great extent, being regulated by the vicinity of brickyards, and the facility of obtaining gravel. I have known concrete executed at 3*s.* 3*d.*, 3*s.* 6*d.*, 4*s.*, 4*s.* 6*d.*, 5*s.*, 7*s.* 6*d.*, 8*s.* 6*d.*, and 11*s.* 6*d.* per cubic yard, although the most common price is 7*s.* 6*d.*; as to brickwork, the general price is 21*s.*, and the range is from 14*s.* to 27*s.* 6*d.* per cubic yard. The London price being 25*s.* per cent. dearer than the country. The facility of obtaining lime regulates the cost of concrete; the price of lime per cubic yard, measured dry in clots, at Dorking in Surrey, is 11*s.*; Barrow in Leicestershire 21*s.*; Bulwell in Nottinghamshire 9*s.* 6*d.*; Breadon in Derbyshire 15*s.* 6*d*; Harefield in Buckinghamshire 16*s.* 6*d.*; Fulwell, Durham County 9*s.* The measures of lime, also, vary much; in some places it is sold by the cubic yard, measured dry, which is decidedly the best method adopted; it would be desirable if it was universal. It used to be sold in London by the hundred, as it was called, not of weight, but a measure, a yard square, and a yard and one inch deep, which will be equal to 16 or 18 bushels, but it is now sold by the cubic yard. The Fulwell and Barrow lime is sold by the quarter, eight of which make a ton and a half. Lime is also sold by the boll and chaldron; a chaldron will be about 3½ tons, a single horse cart about six bolls. In agricultural districts, the bushel, boll and quarter are used; in colliery districts, the chaldron and ton are the standard of measure. With respect to the cost of gravel, provided it can be obtained on ground belonging to the company, the getting, screening, and cartage will cost 1*s.* 6*d.* to 2*s.* per cubic yard; if it be obtained from the gravel pits of the country, the charge will be per ton, from 2*s.* 6*d.* to 2*s.* 9*d.*, if screened 3*s.* 3*d.* to 3*s.* 10*d.*, if broken 6*s.* 10*d.* A cubic yard will weigh from 24 to 27 cwt. If the gravel is dredged or brought from the shores of a river, the cost will be 2*s.* 6*d.* per yard, or nearly the same as from the pit. The prices of the various operations of getting, screening, and washing gravel are respectively 10*d.* and 12*d.* per cubic yard. The price of excavation is also included in the price of concrete in all railway specifications, which will be about 4*d.* per cubic yard, as generally the excavation is of limited extent, and consequently more expensive than an extensive excavation, and when the gravel is obtained on the ground of the Company or proprietor, the excavation is a double operation, the hole having to be refilled with other materials in lieu of the gravel obtained. From the experience of several thousands of yards and variety of situations, I find the cost of mixing the materials, or as it is termed concreting, to be 1*s.* per cubic yard, and taking the proportion of material at 5 to 1, the following will be a fair estimate of the cost of concrete:—

	s.	*d.*
1 cubic yard of lime - - -	12	6
5 do of Gravel at 2*s.* 6*d.* -	12	6
Labour mixing at 1*s.* per yard -	6	0
6 yards of excavation at 4*d.* -	2	0
Waste, contingencies and profit, at 1*s.*	6	0
6 cubic yards, at 6*s.* 6*d.* - =	39	0

Concrete will set in 24 hours; the specific gravity is 125, or about the same as brickwork, although brickwork is sometimes 165 lb. per cubic foot. Lieutenant Denison gives the strength of concrete $S = \frac{lW}{4bd^2}$ The constant S being 9·5, and comparing concrete to York paving, the proportion is as 1 to 13.

The following works may be consulted; Colonel Pasley, on Calcareous Cement: Weale, 1839;—Aikin on ditto, in Transactions of So-

ciety of Society of Arts;—Lieutenant Denison's Notes on Concrete, from papers of Corps of Royal Engineers, *Journal*, Vol. 1, p. 380; Lieutenant-Colonel Reid, ditto, see also the *Journal*, Vol. 1, page 134; a letter on concrete, by a Constant Reader, Vol. 3, page 265, Vol. 5, pages 58, 276.

I am, &c.,

St. Ann's, Newcastle-upon-Tyne. O. T.

WIRE ROPE LIGHTNING CONDUCTORS.

SIR—Having seen, in some of the recent numbers of the *Mechanics' Magazine*, a long discussion as to the priority of claim, respecting the wire rope as a substitute for metal rods, in conductors, I beg to call your attention to a paragraph, which appeared in a work, published by Sir John Herschel, more than 10 years ago. He says thus; that wire rope has long been used at Munich in preference to metallic rods, for lightning conductors. I think this proves that the subject has been long tried and practised, before Mr. M. J. Roberts brought forward the subject.

Your insertion of this will oblige

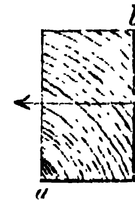
A SUBSCRIBER.

WROUGHT IRON AXLES.

SIR—It is worthy of remark how slowly well proved facts, individually acknowledged and acted upon, become generally admitted; it is to be regretted that we are not more communicative of those events which strike us in our daily practice, and which, if announced as soon as discovered, would so materially and rapidly tend to general improvement. There is, perhaps, no instance in which this can be more clearly exemplified than in the use of wrought iron; it is scarcely possible to refer to the subject without an example being readily laid before you. Every manufacturer has had more or less his attention drawn to the fact, that in its various applications wrought iron is subject to become brittle. Iron spindles, piston rods, fire bars, crow bars, chisels, and many other things, are known to lose their fibrous quality after being in use for a length of time, varying according to the nature of the service they have had to perform. By some it has been considered that the iron originally employed was of bad quality, and the circumstance when discovered has not been otherwise attended to than by replacing the broken piece; but in many instances the phenomena has been clearly established, closely examined, and well attended to, and that for years together, without, however, having become a generally acknowledged fact, sufficiently positive to justify the opinion that wrought iron, applied for certain purposes ought only to be allowed to perform a previously determined quantity of work, after which it becomes requisite to re-forge the piece.

In most cases the fracture may be unattended with danger to human life, but in others, as in connexion with railways, where hundreds of lives may depend on the strength of an axle, it daily becomes more evident that extraordinary precautions must be resorted to for the purpose of avoiding accidents, and I would, with regard to railway axles, suggest (as a precautionary measure) the propriety of limiting the distance they should be allowed to run previous to their being thrown out as unfit for service, and that whether apparently in good condition or not. Such is the perfection with which these axles can now be manufactured, that when a suitable quantity of iron is used, it may be confidently asserted that every axle turned out of the shop after due examination may be considered to be sound, and that by limiting the work it is allowed to perform, the fracture of an axle would become a very improbable event.

Having been lately in Paris, I mentioned the circumstance to M. Arnoux, the directing manager of the extensive works belonging to the Messageries Laffite & Caillard, persuaded that from a person whose attention has been for so many years engaged on this subject, I should obtain some positive information; he showed me a number of axles which he had caused to be broken, after they had performed their allotted quantity of work; they all broke short and brittle, the fracture invariably indicating the progress of the disease. The fracture commences at the lower angle of the axle on the side of the traction, which is evidently in fixed axles the point of greatest fatigue, and in those axles which have given way under the weight of the load, the fissure has in some instances nearly traversed the axle before it broke entirely, and it is then very easy to trace the accident from its engine. I will endeavour to describe its usual appearance by the following diagram; the arrow shows the direction in which the carriage moves.



The fracture invariably originates at the angle *a*, and appears to progress at intervals by zones as shown by the lines in the diagrams, the first, at the point *a* becoming perfectly black, the colour of each being lighter as they gradually extend from this point, and as the contact of the two sides of the fracture becomes more intimate, the grain of the iron towards the angle *a* is coarse, and has a large crystalline texture, which diminishes in size as the fracture approaches the angle *b*, at which point the metal remains slightly fibrous, having evidently undergone a more rapid deterioration at its point of greatest strain.

M. Arnoux informed me, that in consequence of this effect, to which he has for a long time paid great attention, he has come to the conclusion that an axle can only safely run a distance of 30,000 leagues, or about 75,000 English miles; when an axle has run that distance, he invariably takes it out, places it between two new bars of iron, and welds them together so as to form a new axle. If the carriage usually runs over a paved road, such as is frequently met with in France, the axle is not allowed to run so great a distance, and a certain degree of wear in the collar then determines the period at which the axle is thrown out, not in consequence of the wear of the collar, but because that degree of wear has proved, by experience, that it is prudent to renew the axles in order to avoid a fracture.

Here, then, we have the proof of an important principle in the application of wrought iron, being well established and long known to one, and probably to many individually, without having come to the knowledge of railway engineers, who are thus compelled to arrive at this important truth by dint of actual experience, obtained through the medium of a series of lamentable accidents, and they could not acquire their information in any other way, unless made acquainted with the circumstance by those who have previously purchased their knowledge.

The question, then, admitting the above statement to be correct, will be, how great a distance it may be prudent to allow railway axles of different descriptions to run; and to solve this question, it will be advisable, in the first instance, to adopt a term which may certainly be within the limit of perfect safety, until the greatest distance that can be safely adopted may have been determined by a series of well conducted experiments.

Iron exposed to great heat undergoes the same kind of deterioration. I examined, in the same establishment, several bars taken from a furnace in which they heat their wheel hoops; the part of the bar directly exposed to the fire offered the same crystalline appearance as the broken axles, which gradually diminished towards the end that was out of the fire, and the end of the bar which was out of the fire altogether, had the appearance of good tough iron. The portion which had suffered most from its direct contact with the heat, having been doubled over and welded entirely, recovered its fibrous quality, and stood a cold bend as well as any iron that had not been in the fire.

Should you find this communication worthy a place in the *Journal*, you will oblige, by its insertion,

Your obedient servant,

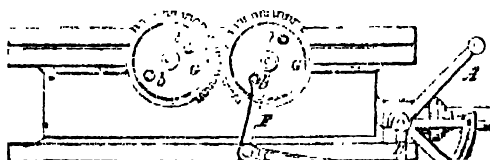
20th January, 1848. H. H. EDWARDS.

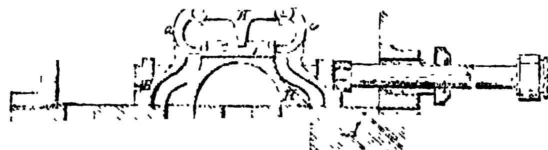
SELF-REGULATING EXPANSION SLIDE VALVE.

Fig. 1.



Fig. 2.





Improvement in the steam engine is so much sought after, so many are engaged in the pursuit, and economy in the consumption of fuel is a question of so much importance, that no apology need be offered on presenting a plan to attain that object, and which has been found here or elsewhere to be an absolute improvement.

The simple apparatus which I am about to describe, (for which I obtained two patents abroad,) has been applied very successfully, and is now getting into extensive use. I believe it to be unknown in this country, except to a few persons to whom I have explained it; and as it will on most occasions be found to be useful, I propose to make it known through the medium of your truly valuable columns, which being open to communications of the kind, and much read, I should be happy to introduce this to your readers through so respectable a channel.

The advantage of using steam expansively does not require demonstration, it is too universally acknowledged to admit of any doubt; I must, however, enter a little into the subject, to point out the benefit to be derived from the application of my slide valve, but will endeavour to be as concise as possible.

An engine working without expansion, receives the steam on its piston during the whole length of stroke, its speed being regulated by contracting more or less the passage through the throttle valve, thereby to a certain extent wire-drawing the steam. The speed of the engine is effectually regulated by this means, but a considerable quantity of steam is thereby thrown away, as I will endeavour to show.

It frequently happens that an engine is lightly loaded, and as the loss to which I allude is comparatively greater with a light load than with a full one, on account of the wire-drawing becoming more complete, I will take for example an engine working with such a load as will require the orifice through the throttle valve to be sensibly contracted, in order to keep down the speed of the piston.

When the engine passes over her centre, the motion of the piston is very slow, and the orifice of the throttle valve will allow the steam to rush into the cylinder in sufficient quantity to exert its full pressure; but as the speed of the piston increases, the quantity of steam admitted becomes insufficient to fill the space at full pressure behind the piston.

The piston continues increasing in speed until it reaches the middle of the cylinder, where it is the greatest, from that point to the end of the stroke the speed decreases until the motion is reversed; there is necessarily a point of the stroke at which the speed is so slow, that the quantity of steam admitted through the throttle valve will be proportionate to the speed of the piston, and from that point until the end of the stroke, as the speed of the piston decreases, the steam will accumulate in the cylinder, and the pressure will increase; but at that moment the position of the leverage of the crank is such, that the increasing pressure of the steam produces comparatively little effect on the speed of the engine, and at the moment at which the pressure reaches its maximum, the slide valve is reversed, and the contents of the cylinder are thrown into the condenser.

The quantity of steam thrown into the cylinder at the beginning of the stroke is not lost, because it continues to act expansively on the piston, and becomes a portion of that volume of steam which determines the speed of the engine and the relative steam passage through the throttle valve; but as I said above, the volume of steam thrown in towards the end of the stroke, only serves to fill the cylinder uselessly at the moment when its contents are about to be thrown into the condenser.

If the engine happens to have a light fly-wheel, the evil is considerably increased, because the speed of the engine will sensibly decrease towards the end of the stroke, the orifice of the throttle valve will be enlarged by the action of the governor, and an increased volume of steam will be admitted into the cylinder just in time to be thrown away.

By working the steam expansively, the above-mentioned loss is avoided; and if the resistance to be overcome was constant—as for instance, to raise a given quantity of water to a given height in a given time—then the fixed expansion would answer every purpose; and this is, perhaps, the only instance in which that can be said to be the case.

Generally speaking, the load is variable, and when that is the case, the point of the stroke at which the steam is cut off should also be variable, so that the steam employed should exert its full pressure while it is being admitted to the piston, in order to produce the full effect of expansion from the moment it is cut off until the end of the stroke.

For this to be carried out efficiently, the engine itself must determine the point of the stroke at which the steam should be cut off, and the governor is sufficient for the purpose. I think I may infer, that the valve hereafter described, will be found useful *for all engines which require a governor to regulate their motion.*

The present system of advancing the eccentric, and constructing the working valve, so that the steam is cut off at about three fourths of the stroke, is an immense improvement, but stops short of what is wanted, particularly for those engines which work with high steam.

The elasticity of steam being subject to the same law that governs the elasticity of atmospheric air, as determined by Mariotte, the elasticity being proportionate to its density, then a volume equal to 200 under a pressure = 2, will be reduced to 100 under a pressure = 4, and will expand so as to represent 400, the pressure being reduced to = 1.

This being the case, let us suppose the length of the stroke of the cylinder of a steam engine divided into 20 equal parts, and that steam of four atmospheres is acting upon the piston during the whole of the stroke; the consumption of steam will be represented by $20 \times 4 = 80$, and the sum of the forces will also be $20 \times 4 = 80$; in this case the consumption of steam will be as 1, and the power exerted will also be 1.

Take the same cylinder, and admit steam of the same pressure during $\frac{15}{20} = \frac{3}{4}$ of the length of stroke, the quantity of steam expended will be $15 \times 4 = 60$, and the sum of the forces will be $15 \times 4 = 60$ for the first 15 spaces, and 16·77 for the remaining 5.

The consumption of steam will be 60 = 1.

The power exerted will be 60 + 16·77 = 76·77 = 1·27.

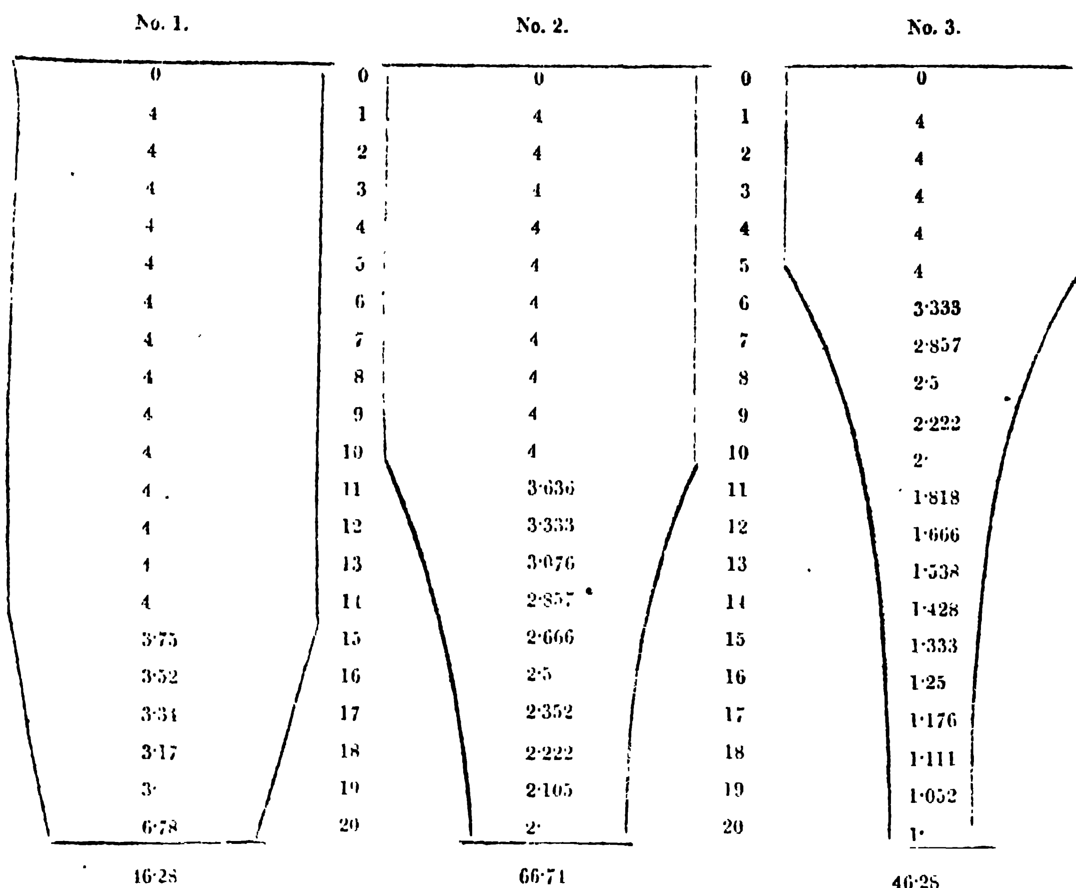
(See diagram No. 1.)

Again, in the same cylinder, admit the steam only during $\frac{10}{20} = \frac{1}{2}$ the length of stroke, the quantity of steam used will be $10 \times 4 = 40$, and the sum of the forces will be $10 \times 4 = 40$ for the first 10 spaces, and for the remaining 10 spaces it will be 26·75.

The consumption of steam in this case will be 40 = 1.

The power exerted will be 40 + 26·75 = 66·75 = 1·66.

(See diagram No. 2.)



Carry this again further out, by admitting the steam only during $\frac{5}{20}$ = $\frac{1}{4}$ of the stroke, and we shall find for the expenditure of steam 5 × 4 = 20, and the sum of the forces for the first five spaces will be 5 × 4 = 20, and for the remaining 15 it will be 26·28.

The consumption of steam in this case will be 20 ÷ 1.

The power exerted will be 20 + 26·28 = 46·28 2·31.

(See diagram No. 3.)

To obtain the greatest possible advantage from steam it is requisite:

1st. To employ it expansively.

2nd. To admit it into the cylinder at its full pressure without being wire-drawn.

3rd. That the portion of the stroke during which it is admitted freely, should be determined by the engine governor.

The construction of this self-acting slide expansion valve, will be understood by inspection of Figs. 1, 2.

A, being the face of the cylinder.

H, the slide valve, acting exactly the same as the ordinary slide valve.

I, a moveable metallic plate, worked by friction against the back of the slide valve H, as far each way as will be permitted by the cam or tappet *a*, the position of which will be determined by the governor.

When the points of the tappets are approached so as to hold the plate I, the slide valve H, alone will move, and the steam will act only during a very small portion of the stroke of the piston.

When the points of the tappets separate, the plate I, will be carried along with the valve, until brought in contact with the tappets, and the greater the distance between the points of the tappets, the longer the steam will be admitted into the cylinder.

When the tappets are sufficiently thrown back to prevent the plate I, from reaching them during the whole length of the stroke of the valve, the fixed bracket K, will then place the plate I in the middle of the slide valve, and the steam will be admitted during the whole length of stroke of the piston, with the exception of what portion may be cut off by the advance of the eccentric.

The two spindles which carry the tappets *a*, pass through stuffing boxes reserved on one side of the valve box, and are turned by two sectors fixed on their extreme ends, and working into each other; the tappets therefore move simultaneously in contrary directions, a lever fixed to the top sector being worked by the governor, so as to separate the points of the tappets *a*, as the speed of the engine diminishes, and to approach them nearer together as the speed increases, and in this way steam will be admitted in such volumes into the cylinder, as will effectually regulate the speed of the engine without ever contracting the orifice of the throttle valve.

This summary explanation is quite sufficient to show the principle upon which this valve is constructed, and by what means the purpose is effected; what follows, is a somewhat more detailed account of the same, useful only as entering a little more minutely upon the subject, and giving some instructions to be attended to in its construction.

To facilitate the setting of the metallic plate I, attention must be paid to the position of the tappets *a*, because upon their position depends the proper effect of the valve. The upper sector G, is keyed on the end of the spindle, and the lever F, is fixed to the sector by two screws *b*, running through oval holes in the sector, which permit the spindle to be turned a little either way, so as to move the points of the upper tappets a little nearer to, or a little further from the plate I.

On the lower spindle the same facility is obtained, by keying a plate on the spindle, instead of fixing the sector itself, and then by fixing the sector to the plate by two screws, giving play in the holes as above, the bottom tappets can also be varied as may be required.

To cause the plate I to adhere to and follow the vale H, in its motion, a spring K, is fixed on the back of the plate I, and the two ends of the spring slide in a groove, formed by two side pieces fixed to the slide valve; this spring is so disposed as to press the plate against the back of the valve.

I have occasionally applied this valve to engines that required to have more steam thrown on to one side of the piston than on the other, and have thereby been able to do away with a considerable counterweight—for instance, in direct engines, where there is considerably more weight in the down than in the up stroke, I have found it very useful; and in another case, in which a cold water pump was attached to one end of the beam, and lifted water from a very deep well.

The motion of the valve being determined by an eccentric, is exactly the

same as that of the piston determined by the crank, but with this condition, that the valve is at its greatest speed while the piston is at its lowest.

If the circle described by the crank pin is divided into equal parts round its circumference, the motion of the piston, commencing from the end of the cylinder, will increase as the versed sine of the arc described, until it reaches the middle of the cylinder, while that of the valve will be as the sine of the arc; and as the difference of the versed sines is constantly increasing, while the difference of the sines decreases, the result will be, that the motion of the plate I, on the back of the valve, must be less the longer the steam has to act upon the piston. The spindles of the tappets must therefore be worked by a motion of the same description as that of the eccentric, and this is obtained by means of the bell crank, A, B, the long arm A being worked by the governor, and made to describe an angle of 90°, the arm B, being horizontal when the governor balls are open, and vertical when they are closed; a graduated quadrant C, being fixed against the valve box, a hand fixed to the extremity of the arm B, of the lever A, B, will show during what portion of the stroke of the piston the steam is admitted into the cylinder.

The pin being pulled out from the lower joint of the lever E, the lever F, will be thrown up by the action of the plate I, against the tappets; the plate being no longer stopped by the tappets will be directed into the middle of the slide valve by the fixed bracket K, and the steam will be admitted to the piston until cut off in the usual manner by the slide valve.

When it is requisite to stop the engine, this pin must be withdrawn, because it is requisite that the plate I, should be always in the middle of the back of the slide valve to be ready for starting; the small quantity of steam that would otherwise be admitted would not suffice to start the engine.

This valve, which I have applied to a great many engines, and which has also been applied by others, answers perfectly well; it is, therefore, not merely a speculative idea that I am laying before your readers.

I applied one pair of them to a locomotive engine, but the result was not so favourable as I anticipated; not that this valve is not applicable to this kind of engine, but because I applied it in an improper manner, and without having beforehand taken into due consideration the several points in which the locomotive differs from other engines. I considerably increased the power of the engine, but did not save fuel, which is one of the principal objects I had in view. I made the cylinder too large; and did not sufficiently provide for the very great speed with which the piston of a locomotive travels, so that I produced in the slide valve the wire-drawing of the steam, which I avoided in the regulating valve; it must also be observed, that a sufficient blast must be determined in the funnel, to secure the generation of a sufficient quantity of steam; this was provided for, but in an improper manner, being only obtained by contracting the orifice of the blast, which would only enable me to obtain a proper effect under a given load and upon a constant gradient; and as on a railroad these two conditions are constantly varying, it is evident that the area of the orifice of the blast should vary also, not only when the steam is worked expansively, but on all occasions. I therefore took out a patent for an apparatus, by the use of which, the blast could be regulated with the greatest nicety, and obtained permission to make a series of experiments with the apparatus, on one of the most powerful locomotives, unfortunately not the one to which the expansion valve was applied, and the result was, what might have been anticipated; the variable blast did not require any assistance, and acted perfectly well in every respect; whereas the expansion valve, which requires absolutely the variable blast, did not produce its full effect without it.

From the very liberal conduct of the company, I am persuaded, that if I had remained longer in France, they would have authorized me to complete these experiments; but family affairs having called me back to England, they remain in an imperfect state, as far as regards locomotives. I, however, went far enough with the experiments to feel convinced, that by the application of the expansion valve in conjunction with the variable blast, a considerable improvement would be effected in the locomotive engine.

London, 19th October, 1842. H. H. EDWARDS.

IMPROVEMENT IN THE MANUFACTURE OF GAS.—A workman employed at Esk Mill, Edinburgh, named J. Lothian, is said to have perfected a most important improvement, whereby a saving of one-half of metal, fuel, and fire, is effected by a new construction of the flues, and situating of the retort. His principle of building flues is also said to be well worthy the attention of those having small establishments, where gas is required. A few days since, he made, in 4½ hours, by one small retort, 846 cubic feet of gas, the same being prepared from various substances.

THE YORKSHIRE ARCHITECTURAL SOCIETY.

SIR—However well-intentioned the regulation may be, that all who are admitted into this society "must be members of the Established High Anglo-Catholic Church," it appears to me to be one of a very questionable kind, whether as regards propriety or expediency. What is exactly meant by the Anglo-Catholic Church, I for one, know not, the term being to me altogether a novel one; but let it mean what it may, it seems that Anglo-Catholicism does not interfere with the "*peculiar sentiments*" of those who profess it! This, however, is touching upon different ground; what I have to object to, is the mixing up religion at all with secular matters, for the doing so is apt to lead to the former being made use of as a mere stalking-horse, and rendered subservient to worldly interests.

Had the restricting *sine qua non* been that all members must be thoroughly acquainted with *Ecclesiastical architecture*, that would have been a very intelligible and proper regulation, and would have answered every purpose, if it really is supposed that no one who is not likewise a member of the Anglo-Catholic Church, can have suitable feeling for, or do justice to that particular style of the art. Or if such be not the case, why should the society exclude architectural talent and ability merely because they may not happen to wear the badge of what it holds to be religious orthodoxy?

If such affected strictness be not *cant*, I know not what is. As far as religion is concerned, it would perhaps be more honest and more consistent on the part of the Protestant church, sternly to reject at once and altogether, whatever, in any degree, partakes of, or reminds us of Roman-Catholicism, its idolatrous worship, its vain and puerile superstitions. Instead of deploring the barbarous spoliations and ravages committed by iconoclasts and puritans, we ought to abstain from attempting in any degree to revive or encourage a taste for a style of architecture, to which we can never do complete justice, but at the very best must always remain immeasurably behind the original models, if merely because we neither have occasion for, nor can possibly admit into our churches, that amplitude of space, and that prodigal display of architecture and art, which, if it does not imperiously demand it, Romanism regards as manifestation of piety. For our churches, we require no long array of ailes and chapels; neither splendid sacristies, nor gorgeous altars: we have neither processions, nor saint-worship; in fact, do not even know anything of, or in any way recognise, many of the saints to whom our churches are nominally dedicated, or rather merely called after for form's sake, and in order to distinguish one building of the kind from another in ordinary discourse. What are St. Giles, St. Pancras, St. Olave, St. Chad, &c., to us Protestants, except so many names, which might as well be those of Egyptian kings?

Therefore, if such matters are of no moment—no scandal to our Protestantism, why should we now become all at once so excessively scrupulous in regard to what are equally matters of indifference? If it can be shown that it is indispensably necessary a man should belong to the Anglo-Catholic Church, in order to acquit himself worthily in building churches, let it be done.

Rickman, who understood Gothic architecture and our ecclesiastical buildings, as well or better than most in the profession—although Gwilt has not thought either him or his work worth any mention—was brought up in the tenets of quakerism, which, though it did not prevent his being employed professionally at some of the colleges at Cambridge, would now have excluded him from the Yorkshire Architectural Society.

It may be said that all this has scarcely anything in common with the objects of your *Journal*, and it certainly ought not; but if people will mix up religion and party spirit, such matters must unavoidably be agitated, and find their way into publications like your own. If qualification of any kind be required from those who seek to become members of the Yorkshire Architectural Society, it would surely be sufficient precaution against the admission of the unworthy, were it made a law that every one—at least every one actually belonging to the profession—should send in as a testimonial of his ability, some original study or design in ecclesiastical architecture; and if his taste should be found orthodox, he might be allowed to pass muster without inquiry as to the orthodoxy of his religious tenets.

I remain, &c.,

Q. E. D.

CANADIAN BOARD OF WORKS

Sir—As you have uniformly taken high and strong ground when discussing the policy of constructing public works by Government, viewing the system as injurious to the community as it is degrading, and indeed, ruinous to the profession, the following remarks on some of the works now in progress or to be soon undertaken by the provincial government of Canada, may not be without interest to your readers. I believe this the more readily, as you some time since (Vol. III, p. 122 et seq.) copied an article from the American *Railroad Journal*, showing the, in every way, injudicious and demoralizing effects of the system here, which paper I should have had much pleasure in condensing for, and otherwise adopting to the English reader, had I supposed the communication useful to you otherwise than as a reference. What I now offer on the public works of Canada, will only too clearly show, that it is not easy to speak too strongly of the wretched system of carrying on these undertakings by agents of government, and with the public money, without any other responsibility than that to party.

My remarks will be confined almost exclusively to the "Improvement of the St. Lawrence," by canals round the rapids above Montreal. These canals are three in number.

1. The Lachine canal, round the Lachine rapids, connecting Montreal with Lake St. Louis, a distance of nine miles. This canal has been in operation nine or ten years, and the locks are 100 feet long in the chamber, 30 feet wide, and 5 feet deep

2. The Beauharnois canal, on the other or south-east side of the St. Lawrence, connecting Lake St. Louis with Lake St. Francis, round the Cascades, Cedars, and Cotean rapids. This canal was commenced in July last, will be from 12 to 15 miles long, is to have locks 200 feet long in the chamber, 45 feet wide, and 9 feet deep on the sill—total lockage 82 feet, prism of canal 120 feet at water line, 80 feet at bottom, and 10 feet deep. Estimated cost £255,900 currency = £211,000 sterling.

3. The Cornwall canal connecting Lake St. Francis with the river above the Longue Soult rapids. This canal is nearly or quite finished, is 11½ miles long, with locks 200 feet long, 55 feet wide, and 9 feet water on the sill. Prism of canal 110 feet at water line, 100 feet wide at bottom, and 10 feet deep. Lockage about 48 feet, cost above £400,000 currency, without any protection to the inner slopes; a precaution found indispensable on the enlarged portions of the Erie canal, (which are only *70 feet* at water line, 12 feet at bottom, and 7 feet deep. Locks 110 feet long, and 18 feet wide.) The excavation of the Cornwall canal was very heavy.

Besides these, there will be several short canals round some of the worst points in the river, which, for the next 35 miles, has a current of from three to eight miles per hour. The aggregate length will be about 10 miles, and the total lockage about 180 feet.

You will observe that the Beauharnois canal has been commenced on the *south* side of the St. Lawrence, in justification of which the chairman of the board of works wrote the letter, a copy of which, in a Montreal paper, I forward to you. The gentleman, in consequence of whose remonstrance this was written, engaged me to examine the question, and, finding no data, or indeed, any engineering information whatever in that paper, I was under the necessity of making such surveys as would enable me to give an opinion, which was to the following effect, that, the incidental works being trifling, and the lockage of course the same on both sides, the difference in cost, £105,000, must be sought for in the earth-work. But, the total cost of this on the north side, was, by my estimate, only £110,000, or, by the prices of the board of works, about £95,000, so that the difference of £100,000 became quite impracticable, as is indeed at once obvious to any eye at all accustomed to judge of ground. *After* my reports were laid before the select committee at Kingston, the board sent in their "estimates," unaccompanied by any report, in which they make out their case; by,

1. Comparing the *worst known* line on the north side; that is, the *last* line run by the board, and designated as No. 10 in the letter I send you, with the best line on the south side, thus making a difference of £40,000 against the north side.

2. By comparing a canal 15 miles long on the north side, reaching from still water to still water, with a canal 12 miles long on the south side, having its western terminus at the foot of a strong current, with extensive rocky shoals between the mouth of the canal and Lake St. Francis, difficulties, which I showed in my evidence, it would cost at least £40,000 to overcome.

My reports will be found in the evidence, a copy of which will be sent to you, and they will enable you at once to sift the facts from the vast quantity of irrelevant matter, with which the board have endeavoured to mystify the very simple points on which the investigation turns.

I will now request your attention to a dispatch of the Colonial Secretary to the Governor-General, dated 2nd of April, 1842, in which Lord Stanley writes: "It can hardly be doubted that works so extensive, and calculated to produce such important results, ought to be superintended by the best professional assistance which it is possible to obtain. Her Majesty's government entertain no doubt of the anxious desire of the Canadian Board of Works to discharge with fidelity the arduous duties which will devolve upon them; but I can as little doubt the anxiety which they must feel to have associated with them in such a trust, the best professional assistance which it is in the power of the mother country to furnish.

"It is therefore, my intention, in anticipation of the acquiescence, which I cannot for a moment doubt, of the colonial legislature, in the general arrangements suggested by Her Majesty's government, to send over an officer of engineers, whom, as Her Majesty's commissioner, I trust the legislature will have no difficulty in associating with the board of works, in the superintendence of the works to be undertaken; and whose experience may probably enable the undertakings to be conducted with the efficiency and economy which must be alike the interest of the colony and of this country."

Sir Charles Bagot replies, 28th of April, 1842: "Of course, as her Majesty's government provide the funds with which the public works are to be conducted, it is but reasonable that they should have a share in the management of it, if so desired."

His excellency then goes on to object strongly to a "military engineer," and suggests a "civil engineer," an expense it is well known the home government will not incur; in the mean time the work is commenced before even the centre line or the levels have been established.

Lord Stanley writes on the 2nd of July, 1842: "In your dispatch of the 28th April, you admit the necessity of appointing an engineer officer, as commissioner on the part of Her Majesty's government, to superintend the execution of the works which may be undertaken, and point out the reasons which induce you to prefer a civil to a military engineer.

"On this subject, I have only to observe, that if provision be made by the legislature for the payment of such an officer, (which, I agree with you, will be very desirable,) Her Majesty's government would have no preference for a military over a civil engineer, nor any wish on the subject, but to procure the services of the most competent person who could be engaged for this purpose."

Now, I have no hesitation in asserting, that, had this officer been sent out the canal could not possibly have been placed on the south side of the St. Lawrence. For, the examinations which he would have found it his duty to make, *before* giving his acquiescence, would have shown him that the south side had no advantages in an engineering point of view: and no English engineer, civil or military, could well tolerate the position of the Governor-General, that "ceteris paribus" he should "*probably*" (!) give the preference to the north side. The stern reply of Lord Stanley to this flippant remark, in which he expresses "his regret" at the "sacrifice of the military advantages" of the line on the north side of the St. Lawernce, cannot fail to strike you as proper and manly, as well as decidedly called for.

But the great object of the work is commercial; and, in this point of view, the examinations of the engineer of Her Majesty's government, would have shown him, that the line on the south-east or *lee* side of the St. Lawrence, must on that very account, and with any expenditure, be *somewhat* inferior to the line on the north-west side; in other words, that the "military advantages," so highly prized by Lord Stanley, were to be "sacrificed" not to aid, but rather to injure the commercial interests of the country. So general is the belief in the want of common honesty evinced in this transaction, that the large sum (£30,000 or £40,000) already expended on the south side, constitutes *now* the only argument in favour of continuing it on that side of the river. I am, however, of opinion, that this will avail little, if Lord Stanley send out an engineer—civil or military, I care not which—who, with even a little practice, is not deficient in self-respect and integrity. Such a man will soon discover, that a canal adapted to the trade of the country, will be worth more, both as regards facility of working, and—what is most important—low tolls; which latter must obviously be in proportion to the cost, than a canal of the present preposterously colossal dimensions. Hence, even £100,000 may be spent on the south side; and the commercial as well as national interests may be advanced by the construction of a canal on the north side, in such a manner and of such dimensions as prudence, experience, and common sense shall point out.

Lord Stanley will hardly brook being told, that, the canal having been commenced, it is useless to look back—that it is better now to submit to the imposition, infamous though it be, than sacrifice the work already done—that the honour of the government will be sufficiently appeased by dismissing the board of works with disgrace, and similar arguments of those whose only escape from a wretched bargain—if so mild a term may be applied—lies in the momentary and imaginary value which the construction of a "ship canal" to the "great lakes" along the Seigneury of Beauharnois may give to that property in the London market. But should Her Majesty's government sift this matter thoroughly, not only may the canal on the south side be stopped, but Sir Robert Peel—the unwavering friend of private enterprise, the grand secret of British supremacy—whose policy would never have originally given the imperial security for £1,500,000 sterling, "*cette pilule dorée*," as it was contemptuously termed by a leading French member of parliament—may feel himself called on to cancel the endorsement, when he discovers that the munificence of the home government serves only to the direct injury of the commercial interests of the colony; to the neglect of the military interests of the present state; of the agricultural interests of the colony; and, worst of all, to the demoralization of the colonial government and people. For, not only does the present course resemble that of the worst of the subsequently repudiating states, but there is superadded a degree of cool and mendacious effrontery almost incredible, on which, indeed, the main chance of success now rests. Thus, after reading Mr. Killaly's letter, you would be surprised to learn, that, the "French engineer" is *supposed* to have been a Canadian surveyor, his very name being even unknown. Survey No. 2, by Mr. Mills, led that gentleman to give the pre-

ference to the north side, (Nos. 4, 7, 8, 9, and 10, have obviously no bearing on the question.) No. 5 was by a country surveyor, and he merely points out some disadvantages in one route on the north side. No. 6, Mr. Baird never examined the north side; and, though in Kingston at the time, was not called in by the board; the superior "economy, and facility of navigation," consist in a violent current and lee shore; that a vessel which can navigate the canal, can neither get in nor out at the western terminus; that the three channels are pure fabrications, and that this is not the first extensive public work "undertaken through a district entirely settled and inhabited by Canadians of French origin." The Champlain and Lawrence railway runs through such a country, and was built almost exclusively by these Canadians; the Chambly canal also traverses such a country. On the latter work I served as assistant engineer in 1831; and the former was built under my directions, *by the day*, and opened in July, 1836. The evidence shows all this and much more; but I will proceed with some observations on the commercial prospects of the St. Lawrence canal.

The grand object of the undertaking is to attract to the St. Lawrence a large portion of the western trade, on the assumption, that the larger the canal, the lower the rates of freight; and, secondly, that the cost of transportation from the great lakes to Montreal, is the only drawback to an unlimited trade with the west—positions altogether untenable.

Barges now descend the St. Lawrence from Lake Ontario to Montreal, with from 100 to 150 tons freight, according to the depth of water in the "Cedar Rapids," where the barges frequently touch on the boulders, with which the rocky bed of the river is covered. There is only 1½ feet water here in the autumn, but, by clearing out the channel, it is believed that boats drawing 5 feet water may descend at all times. Such boats would carry 150 tons, or, if made of iron, 200 tons of freight, and with a proportionate reduction in the cost. A bill appropriating £10,000 currency to the improvement of the Cedar Rapids was introduced at the late short session, and the prerogative alone prevented its passing, as it met with universal favour. I send you a sketch of the contemplated plan, with a description in the *Montreal Gazette*, by Mr. Henry Roebuck, the projector of this, the first attempt to improve the downward navigation of the St. Lawrence. The average regular charge is 1*s.* 9*d.* currency per bbl. of flour from Kingston to Montreal, a distance of more than 200 miles by the river = ·195*d.* currency per bbl. per mile = 18*s.* 3½*d.* currency = 15*s.* 2*d.* sterling per ton of 2240 lb. (Flour was carried during the late summer for 1*s.* sterling per bbl.; and merchandize was carried up for 25*s.* currency = 20*s.* 8*d.* sterling per ton, by the Rideau canal, a distance of 210 miles, during a strong competition.) The *tolls* on the present Lachine canal are 2*d.* currency per bbl. of flour for 9 miles = ·222*d.* currency per bbl. per mile, or more than twice the total cost per mile through, ·105*d.* currency, as above.

The Erie canal of New York, with which these canals are to compete, has locks 90 feet long, 15 feet wide, and 3½ feet water, prism of canal, 21 feet at bottom, 40 feet at water line, and 3 to 4 feet deep. The tolls are 1*s.* 9*d.* currency per barrel of flower for 363 miles = ·0578*d.* currency per barrel per mile = about one fourth the tolls of the Lachine canal[1] thus showing an immense advantage in favour of the Erie canal—an advantage due to the cheapness of its construction; in other words, to its reasonable dimensions. How then is transportation to be lessened, by expending two or three times its original cost in enlarging the Lachine canal[2] The high tolls have driven the forwarders to try the Lachine Rapids, and during the past summer and autumn a vast number of boats have gone safely over. There is a great depth of water, but the channel is narrow and crooked. (The descent is about 30 feet in 1½ to 2 miles, which is passed in 4 or 5 minutes, the inclination of the surface of the water being such, that the force of gravity acts on the boat, thus producing a great velocity through the water in addition to that of the current. A heavily laden barge overtook a light steamer in the rapids, fortunately without injury to either—and the first season of this navigation has passed without accident.)

Now were individuals expending *their own* money on these canals, they would endeavour to ascertain whether the income—the true test of the accommodation to be offered to the trade—would justify the construction of canals of a size unknown, in Christendom at least, and would enter into the calculations and investigations necessary to show *how* this reduction of freight was to be effected, and *why* barges of 150 tons were so much less efficient than vessels of 800 to 1200 tons. But, in place of this, the public have heard nothing beyond such vague assertions as, that "the St. Lawrence is the natural outlet" for the "boundless trade" of the "far west;" if the Erie canal, with its pitiful craft of 50 tons burden—omitting all mention, or more probably ignorant of its small cost and low tolls—has yielded such large returns to the state of New York, what may not be expected from the "ship canals" of Canada, when "sea-going" vessels shall "float on Ontario and Erie," the Welland *schooner* canal connecting these lakes to the contrary notwithstanding—and innumerable other equally preposterous views and bombastic expressions, which are only too likely to prove as ruinous as they are ridiculous.

Yet this little Erie canal, which the State of New York has been endeavouring to enlarge to a size somewhat greater than that of the—according to Canadian ideas—little Lachine canal, and on which she has thrown away £3,000,000, is now admitted to be equal to any trade which can be expected, though there is no St. Lawrence to distance all competition for the down freight, no Rideau to compete with for the up freight, and although it enjoys a monopoly of *all* western freight, the people of New York not being permitted to use the railways along side of this canal on any terms—not even in winter—for the transportation of freight. These railways are owned by private companies, the government dreads their competition, and not without reason. For instance, flour is carried from Albany to Boston for 1*s* 6*d.* sterling per barrel, a distance of 200 miles by railway, through, or rather across, a mountainous country, or at the rate of ·09*d.* st. per barrel per mile, in small quantities (in full loads for 1*s.*); the rates from Buffalo to Albany, 363 miles, average 3*s.* 3*d.* st. per barrel of flour, or ·107*d.* st. per mile = 16 per cent. more than the highest charge on the Western Railway of Massachusetts. This latter is a private work, open throughout the year, and without any monopoly; the Erie canal is a State (government) work, closed between 4 and 5 months every year, and sustained by a monopoly unparalleled on either side of the Atlantic. The enlargement of this canal is postponed indefinitely, and a direct tax on every species of property in the State has been laid, to meet the interest of the money squandered on this and other legislative engineering follies, pointed out in Vol. III. (p. 122 *et seq.*)

Without stopping to inquire how soon this course will become necessary in Canada, I will ask, what intelligent Canadian or Englishman, who has visited New York and Canada, will for a moment tolerate the idea, that the trade of the latter country is likely to require, not equal, but ten times greater accommodation than that of New York? Should the trade of the St. Lawrence, twenty years hence, equal that of the Erie canal at this time, it will show an increase unequalled in the annals of this country. Look at the most, if not the only, successful work in Canada, the Champlain and St. Lawrence Railway, 15 miles long, and which cost not quite £10,000 sterling, on which 50 per cent. has been paid to the stockholders during the last six years, *because* the capital was small, and the outlay made with some reference to income. Had this been made with three or four tracks, on the scale of the Great Western Railway, it would have been as profitable to the stockholders as the St. Lawrence canals are likely to prove to the Province. One mile and a quarter of the Cornwall canal has cost as much as the 15 miles of railway, including cars, engines, buildings, wharfs, and steam forage-boat of 300 tons, whilst the income bids fair to be inversely as the cost; a fair illustration of the mode of conducting public works by private companies, as compared with that generally pursued in New York and Canada, where the helm is only too often in the hands of political adventurers and desperate speculators, who, having every thing to gain by governmental extravagance, naturally employ kindred spirits to execute their designs, which are, usually, the expenditures of large sums in certain districts, without any regard to the wants or interests of the community.

The gross receipts on the Erie canal for 1840, were 1,597,334 dollars = £330,028 st., and the present year will yield about the same amount. Assuming the St. Lawrence canal to be about one-ninth the length of this canal, and supposing the same business, the receipts would be very nearly £50,000 cy., on an estimated expenditure of £1,013,074 cy. as per Mr. Killaly's memorandum of 12th Aug. 1840, in which occurs the only argument (!) vouchsafed to the community for the necessity of this additional accommodation to the trade at such enormous cost.[1]

On the Erie canal the up freight or merchandize yields only one-fourth of

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[1] The following choice *morceau*—the style of which is worthy of the reasoning—is all I have been able to discover.

"General Observations. The necessity of involving the province in the cost of forming a second water communication with tide-water, has been for a long time the subject of dispute and argument with many. Among the number of those who doubted the prudence of it, I was one until latterly; but the vastly increasing trade, *doubling almost annually*, and the conviction upon my mind, after mature consideration, that the lowering of freight consequent upon affording additional facilities, together with the productiveness of the western countries, which are only now coming into operation, will increase still further this trade *to an almost inconceivable extent*, have convinced me that a second and more facile outlet is called for. Besides the transport being confined to the Rideau, the navigation of which depends upon the stability of dams of great height, (in one case 60 feet,) should any injury arise to one of these dams, (as was apprehended last spring,) either through accident or malice, the effects of it would be ruinous to half the commercial interests of the country.

"I am decidedly of opinion, that the scale upon which the Cornwall canal was undertaken, was unsuited to the means of the province, and was not absolutely necessary for the greatest increase of trade, which the most sanguine may look forward to; and that a schooner navigation, combined with a system of tug-boats would have answered every commercial purpose; but now, from the large expenditure already incurred upon the central portion, *the little required to complete it*, and the comparatively small saving that might be effected upon *what remains to be done*, by adopting the schooner scale, I am led to conclude that the best and easiest course will be to open the St. Lawrence throughout from Montreal to Lake Ontario for steamboats and schooners—not upon the *full size* of the Cornwall canal, but on a scale sufficiently large to admit a powerful class of steamers or tug-boats to pass." (Memorandum, 12th Aug., 1840, p. 5.)

It is scarcely necessary to say, that the "doubling almost annually" is bombast to an almost inconceivable extent; that "the small saving" is no less than on 28 miles out of 40, and the diminution consists in reducing the canal from 140 to 120 feet in width, and the locks from 200 by 55 to 200 by 45—a distinction without a difference you will say.

the income; on the St. Lawrence, the ratio is much more unfavourable, probably not less than 8 or 10 to 1, as the Western States, which furnish the flour and pork for the Montreal market, receive their merchandize exclusively by way of New York and the Erie canal; hence the greater the exports or down freight *via* the St. Lawrence, the greater the imports or up freight *via* the Erie Canal. But the down freight for Montreal will, practically speaking, all go by the river; hence £8,000 to £10,000 gross income would be a high estimate for the up freight of the St. Lawrence, if charging the same tolls as on the Erie canal, or four times that income at the present rates of the Lachine canal. Some little income will also be derived from the occasional passage of the steam-tugs employed to tow barges between the different sections of the canal. It will be observed that this calculation supposes the trade equal to that of the Erie canal, and that the estimates are entitled to confidence. The difference in the former is such as to forbid comparison, and the mere dimensions of the Beauharnois canal, given in the beginning of this paper, will be quite sufficient to show the inaccuracy of the latter—to say nothing of the actual cost of the Cornwall canal, built principally under the superintendence of the able resident engineer of the Beauharnois canal.[2]

It is quite unnecessary to point out the improbability of vessels of 600, 800, or 1000 tons or larger steamers competing with barges of 150 tons drawn by horses on the canals, and by steam or wind, as at present, on the river between these canals; but, when we find that the latter craft can descend the St. Lawrence (without paying tolls) with seven-eighths of the freight, and that a suitable canal for the ascending trade would cost about one-fourth as much as the "ship canal," and be more efficient too, we are led to conclude that the whole affair would do no discredit to the "par excellence" land of jobs itself—the "sister island." The enlargement of the Lachine canal is about to be undertaken the coming winter, estimated cost £225,300 currency; and how this measure is to reduce the enormous tolls of that canal, which have already forced the trade to try the river, and successfully too, is a question not to be answered—in the affirmative, at least. The greatest possible reduction in freight I consider to be 6*d*. per barrel of flour, an amount quite insufficient to increase the demand in England, the very source of this trade, whilst freights from Montreal vary during the season not less than 2*s*. sterling per barrel, according to circumstances; a vastly more important consideration than any diminution which can be even anticipated between Montreal and Kingston. (The last Montreal quotations were 6*s*. sterling, from New York 1*s*. 6*d*. sterling, per barrel of flour.)

The Toronto paper, accompanying this, gives very fairly the general view taken by the entire agricultural and no small part of the commercial community; and, in continuation, I will add, that by none did I hear the idea of using the canals for down freight ridiculed so much, as by French members of parliament, whose knowledge of the capacity of the river is nearly equal to that of the forwarders themselves.

A variety of other important facts might be adduced and different means taken; among the rest, the amount of business necessary to clear expenses and interest; and the amount of income which the present trade would yield; also the quantity of freight from western states seeking the New York market *via* the Erie, or Welland and Erie Canal.[3]

[1] The respectable British and American engineers who are, have been, or may be employed by the Board of Works, must not be confounded with the Board proper. They have merely to execute what their superiors, as politicians and intriguers, but their inferiors as men and engineers, are pleased to direct, and have nothing to do with the projecting of the works, as will be easily believed.

[2] Taking the interest and expenses at £60,000 currency, and the toll at 2*d*. currency per barrel of flour, it would require 1,800,000 barrels, about 7 times the present trade, to furnish the income, if even this comparatively moderate toll would induce boats to use the canals, and if the estimates of cost are correct. Besides the toll on the freight, the *boat* pays 1*l*. toll, and 12*s*. for towing through the nine miles of the Lachine canal, which for the 40 miles of canal would cost more than insurance and pilotage from Kingston to Montreal. The insurance is three-eighths of 1*d*. per pound; the pilotage about 2*l*. per 1000 barrels.

Allowing 30 minutes for passing one lock, and the entire present annual downward trade would pass through the Cornwall canal in 24 hours—the up trade before dinner, or at a point before breakfast. The river is equal to millions of tons per day, and the vast saving of time—already important between Lachine and Montreal—is an inseparable argument against the canals for the *down* trade—in other words, for *the* trade. The earlier and later navigation in spring and autumn is also important.

The Welland canal cost up to August, 1841, £191,777 currency, and requires, by estimate, £150,000 to complete it. (Memorandum, 12th August, 1841, p. 5.) The income for the last three years, has been about £25,000 currency, Mr. Killaly's "doubling almost annually an inconceivable extent" to the contrary, notwithstanding. The principal part of this is from down-freight, and a part also from American trade. With a navigation equal to that of the St. Lawrence, the income would be about £6000. Its principal hope of success rests on its becoming an American thoroughfare, which I think it eventually will be, for reasons given in my paper on "the spring trade" in the American *Railroad Journal* of April 15th, 1842.

Vessels drawing 12 to 14 feet water are brought with difficulty up to Montreal; and as for taking "ships" through 560 feet lockage up to Lake Erie, it will be at once obvious to the readers of the *Journal*, who have any acquaintance with inland navigation, that such views can be entertained only by those who are ignorant of the cost, weight and awkwardness of ships in canals. Should the trade become great, it is clear that the transhipment will take place at Quebec.

However new these statements of business may be to many of your readers—and obviously indispensable as they are to a correct understanding of the wants of the trade of the St. Lawrence—I believe they will be quite as new to the Canadian Board of Works, supposing that a Journal advocating such principles as this should accidentally meet their eye.

It was remarked, by the President of the Institution, (I think,) that many of the young engineers of England must necessarily look to the colonies for employment, hence the state and prospects of the profession in Canada cannot be received with indifference by British engineers in general; and it is on this account that I think the course of the Canadian government should not escape the scrutiny of the leading members of the Institution in London.

The honour and advancement of the colony and of the profession, as far as public works are concerned, must be considered as the same; and it is hard to say whether the Canadian Board of Works are doing more to injure the trade of the country, to degrade the engineer, or to effectually extinguish in Canada, that vital principle of British institutions—private enterprise.

I am, Sir,
Your obedient servant,
W. R. Casey.

New York, 30th Nov., 1842.

THE EDUCATION OF AN ENGINEER.

[illegible] prospect of Engi[illegible] and its Disc[illegible].

By H. F. Clifford.

Our estimate of the value of any scientific pursuit, consists chiefly in the degree of importance we assign to the amount and nature of the several qualifications due to its proper attainment. When we reflect upon the characteristics of engineering, we are not long in discovering it to be a science requiring much deep and intellectual study, assisted by steady perseverance, long and unceasing application to arrive at a just appreciation of all those practical data which experience can alone furnish, and impress vividly on the mind; one in which the [illegible] of the artisan must be blended with the [illegible] theories of [illegible] mathematician, one, in fact, embodying the perfect union of theory with practice; but to define engineering in the sense of the word, would be an endless task, for in that single word is comprehended a general knowledge of all the artifices that human ingenuity can devise to supply the conveniences of the present advanced and rapidly progressing state of civilization.* This definition may, indeed, appear vague to some; but when we are informed of the vast grasp it takes of all those sciences which require no ordinary mind to cultivate and condense for the purpose of obtaining a thorough comprehension of the numerous ramifications of so noble and deeply interesting a study, we cannot be called presumptuous in placing it second to few, if any of our standard professions. Since, however, engineering as a comprehensive and distinct science has become fully recognised, and taken up its full position high in the rank of secular callings, there must have been long felt a growing deficiency of some fixed laws or definite principles to guide such individuals as were desirous of attaching themselves to the profession as a means of support, in obtaining a thoroughly useful knowledge of the subject. It is not our intention to throw any unreasonable objections in the path of the young aspirant to engineering fame, but we would seriously urge on his attention the necessity of engendering at the onset a firm and unchangeable resolution to encounter numerous and severe difficulties; but to be forewarned is to be pre-armed, and in the following remarks, which are the substance of a few years' careful observation, we have endeavoured to point out the general features of such a course of probationary study as from experience we have great confidence in recommending for adoption; being fully persuaded, moreover, that the only way to render engineering ultimately serviceable, at least in a pecuniary point of view, is to effect the happy combination of the practical with the civil department. For it is almost chimerical, now-a-days, for any person to imagine he will ever succeed solely in the capacity of a "Civil Engineer," inasmuch as civil engineering is a profession commanding but a very limited practice, and that what practice there is must inevitably fall to the lot of men whose public works have already earned for them an undying name, and with whose lives it will perish as a distinct avocation. Neither, on the other hand, can we recommend any one to pursue practical engineering alone, that is the business of an engine builder, for it is one requiring large capital to erect workshops

and supply them with the necessary machinery; and moreover, there is not nor will there ever be now, a sufficient demand to employ all those first-rate works that have been established for many years, and whose name is a perfect guarantee for a good article. Again, owing to the slow but gradual development of the system of constructing manufactories on the continent, conducted by skilful Englishmen, there is every reason to believe that when the system arrives at a state of maturity, the foreign consumption of English machinery, especially locomotives, will be almost entirely annihilated. It is true, however, that there is a body of men, managers of large works, receiving no despicable salaries, and to a casual observer their occupation presents fair means of remuneration; but then what man is there accustomed to the usual comforts of life who would sink the better part of his early life in a workshop, as would be necessary to fulfil creditably such a situation? N Such offices are chiefly held by men who, originally of the better class of mechanics, have gradually raised themselves above the level of their brethren by the exhibition of no ordinary talents, and have thus become entitled to the appointments as being the fittest parties from the nature of their previous education and intercourse with men whose habits and discipline they are best able to appreciate and to govern. With these few useful premises we now proceed to show the requisite functions to qualify a man to act successfully as an engineer. Let it be ascertained, as early as possible, that the person in question intends becoming an engineer, for having determined this important point, no time will be lost in acquiring any information foreign to the purpose. Latin and Greek must be entirely eschewed, and in the earlier portion of the student's career, let him obtain a tolerably clear knowledge of geography, history, arithmetic, English, French and German, the rudiments of ornamental drawing, sketching, the first three books of Euclid and Algebra. The consideration of the above will possibly occupy the student's attention up to the age of fourteen. From fourteen to sixteen finish Euclid, take up practical geometry and the higher parts of algebra—read plane trigonometry, conic sections, mechanics, hydrostatics, and hydrodynamics, the differential and integral calculus, and in order to connect more firmly together the links of this mathematical chain, work numerous problems involving each and all of the several branches. The elements of geology and chemistry, and such other parts in detail as bear more immediately upon civil engineering have great claims on the pupil, whilst a strict attention should be given to mechanical drawing, sketching, linear, and isometrical perspective, with the theory of shadows. During this period, likewise, the student should make a practical investigation of surveying, and learn to use, with ease and accuracy, the level and theodolite, to make himself acquainted with the general principles of architecture; and, in order to prepare his mind more fully for the reception of its future tenant, peruse some standard elementary work on engineering.

Having completed his sixteenth year, and assiduously devoted all his energy to the investigation of the foregoing subjects, let the embryo engineer be now placed in some first-rate manufactory, where there is a great variety of work executed, for a space of not less than three years. We repeat, *first-rate* manufactory, for as his standard of judgment of mechanical productions will be formed in a great measure by the quality of work passing under his notice during this time, it is proper he should connect himself with one of the highest repute. Here he will lay up an ample store of solid information regarding land, marine, and locomotive engines, mill-wright work, and, in fact, machinery in general. But this information, we can assure him, is not to be purchased in the character of an on-looker. He must keep the same hours as his fellow workmen (*pro tempore stante*); he must exchange his ordinary attire for the fustian suit, the drawing room and easy chair for the workshop and the vice, and go through the various gradations of the service till he is found competent to undertake some responsible situation over the workmen. And it is a well known fact, that it is impossible for a man to pass a correct and conscientious opinion with regard to the execution of any mechanical work, unless the individual in question has himself gone through a regular system of practical application. It is true the beginner, unused to the rough habits of a workshop, and unaccustomed to associate with such characters of men as he finds there, will have to contend with many inconveniences and annoyances, but then he must make up his mind to wield the hammer, chisel, and file, with a firm determination to overcome all difficulties. We admit it requires a strong and persevering resolution, and many are they, beginning with a good heart but meeting with impediments at the commencement, have shrunk from the prosecution of a course of training, which, pursued to completion, would have amply repaid them the extra exertion due to its attainment. Locomotive building claims especial care for its subsequent utility, and let it be a leading principle throughout the entire course, to ascertain correctly and set a due value upon the proportionate strength[1] and properties of materials in general, that the engineer may be able to adapt with confidence such invaluable knowledge when he may hereafter find it available. For the *requisite* strength is alike conducive to symmetry of figure and economy of material—an intimate acquaintance with the relative functions of the various descriptions of water wheels[2] is indispensable to the engineer, on account of the great utility and *economy* of such power in countries and districts where water abounds, and where it would be both inconvenient and expensive to erect steam engines and their concomitant paraphernalia. The foundry must likewise have its due share of importance, and the student should contrive to obtain an introduction to some large iron works. Here he could devote a short period to analyzing the processes of smelting, puddling, casting and forging, and thus render himself capable of passing a good judgment on the quality of malleable and cast iron, when coming under his notice for engineering purposes on future occasions. Although mining engineering is reckoned a distinct branch, and requires long experience underground as a viewer to sustain any responsible situation, still a short time passed in investigating colliery work in some well regulated coal pit, would make the pupil acquainted with much valuable information concerning pumping engines, and the general routine of the mechanical department as would be of material service to him. During his residence at the manufactory, practice in drawing should be kept up by periodical visits to the drawing office, and he should endeavour, on all occasions, to procure for himself copies or tracings of any useful piece of mechanism, and thus, by carrying the principle out in time, amass a series of practical illustrations of invaluable use in after life. Lastly, in order to render the former part of his education ultimately serviceable, the pupil should, during the evenings after work hours, peruse attentively such works as treat more immediately on subjects forming the constituent elements of his profession, and for the purpose of blending amusement with instruction, we could suggest reading at his more leisure hours, and thus keep pace with the constant improvements, the best periodicals that treat practically and theoretically of civil and mechanical engineering. Having completed the first grand epoch in the probationary regime, the pupil may easily refresh himself with the pleasing intelligence, that the remainder of his duties are comparatively easy to the ordeal he has already passed through. The next step is to place himself under the direction of an eminent civil engineer, who has railways and other works connected with this department of engineering under his superintendence in course of construction. In this new state of things, the pupil should strive hard to obtain some inferior, but by all means *active and responsible*, station, for there never is that care and attention bestowed on any object that is simply dependent on *our own* caprice. The pupil should, therefore, consider it a matter of paramount importance to endeavour sedulously to create a high confidence in his own and his superior's mind, that may lead, as soon as possible, to his entrustment with some minor office, the credi able discharge of which depends entirely on his own exertions. For confidence, let it be understood, is the capability of expressing a decided and correct opinion with regard to any question that may arise, and which can only be given in cases where a thorough comprehension by *experience* of the details of the point at issue is positively entertained. With civil engineering commences a new era. Railway making, with its surveying, levelling, cutting and embanking, bridge building, drainage and other works, will serve to keep the mind continually employed, in order to become well versed in all its minutiæ. The building of harbours, docks and light houses, the formation of canals, will severally claim a proportionate degree of careful consideration. Common road-making, warming and ventilating, general principles of carpentry and masonry, with a train of minor but no less useful qualifications, will in due order require each its own peculiar study: lastly a real concise method of making estimates and getting up specifications for contract works, will be found of great utility; the former can only be obtained by ascertaining on all occasions the prices of every description of materials for engineering purposes in the different localities, the latter by continual reference to specifications of works already executed. Here, then, is a broad field open to the successful practice of acquired knowledge, whilst design and construction present favourable opportunities for the display of any talents or ingenuity the young engineer may be fortunate enough to possess. To acquire a sound knowledge of the strength and properties of wood, stone, and iron, should be considered a matter of the utmost importance, and a few months could be profitably passed in an architect's office of good repute. We have mentioned the preceding qualifications *en masse*, but they should be carefully and discriminately adjusted to the age, ability, and progress of the student. Let the different subjects be presented to his notice in their most elementary shapes at the onset, that the rudiments of one and all may be indelibly fixed on the mind; for then the intellectual faculties having mastered the approaches, will grasp with a firmer hold upon maturer development the more complicated facts. And it should not be lost sight of, that the amount of information acquired, depends almost entirely upon the youth's own assiduity, as he will not find persons continually at his elbow, as in the schoolroom, either urging him on or threatening him with punishment for neglect of duty. He must see

[1] By proportionate strength we mean the relative strength the severa parts of any piece of mechanism should bear to one another.—Tredgold, Barlow, &c.

[2] Smeaton's experiments.

clearly it is to his *own interest* to make the best possible use of his time. It is not within the limits of an article for a Journal, to enter more fully into detail, but we have endeavoured in as brief a manner as consistent with the nature and magnitude of the subject, to draw the outline of a plan of education, that from *actual* trial, we can seriously recommend for adoption. We would fain conclude here, but cannot resist making a few passing remarks on the several schools for engineers that have lately sprung into existence. However radically good the principles and intentions of any establishment may be, professing to teach a young man engineering, however well such principles may be carried out and matured by able and efficient masters, they will fall immeasurably short of their purpose, when compared with the preceding course. For it is not within the limits of a school-room education, to convey that inestimable practical knowledge, which can only be acquired by constant every day association with bodies of men, whose daily bread is earned with the sweat of their brow, and who can readily and satisfactorily explain any questions or doubts that may arise connected with their individual trades. The latter course may, indeed, materially assist the embryo engineer in the earlier part of his career; but having arrived at a suitable age, the workshop, and then the open field, from the staking out of the railway to the laying of the permanent rails, will be found far more congenial to the spirit and practice of engineering. In conclusion, it is our decided opinion, that an individual educated according to our method, and possessing, in a fair degree, all the advantages arising from it, will be fully competent, at the expiration of his articles, to undertake some responsible and remunerating situation; and it is not too much to anticipate, that if he be an industrious and persevering character, he will materially benefit any works with which he may become connected and with good natural talents, assisted by standard ability, he may possibly shine forth a bright star in the wide sphere of a distinguished profession; and should he not be fortunate enough to rival the memories of Brindley, Smeaton, Telford, Watt, Stephenson or Brunel, he may perhaps leave behind him lasting monuments of his skill, that would do credit to his more illustrious and deservedly renowned predecessors.

Now for a few words bearing on the prospects of engineering, and its disciples. When we review the statistics of railways, and reflect upon the enormous quantity of money (£70,000,000) expended by private individuals on such speculations, within the limited period of railway existence—when we consider the little return such parties have had for their invested capital up to the present time, the heavy loans several companies have still to pay off, notwithstanding the fallacious exhibition of prosperity, in the declaration of a moderate dividend to the shareholders—when, moreover, we consider the ruinous state of trade, the prevalence of distress, the sluggish circulation of specie this last two or three years, caused by the diffidence of large money holders to let it change hands—and when, lastly, we contrast the superabundant supply of engineering skill compared with the demand, we cannot feel surprised taking full cognizance of the above, and many other contingent circumstances, at finding engineering in the unpromising condition it has presented of late. It is now generally admitted, that profuse expenditure has been the prevailing feature of railways hitherto constructed; and it should be the aim of future companies to complete their engagements with as much economy as is consistent with the durability and magnitude of the undertaking. We do not object, let it be understood, to additional expense being bestowed on the great arteries diverging from the metropolis, for such may be looked upon as public works, and have a reputation to hold up; but the smaller veins branching from the main trunks, should be made at as little cost as possible. Once let a right spirit of economy be established between the directors of railways and their engineer, and we shall soon have public confidence restored, and a new impulse given to the profession. There are many lines that must be laid out and finished, to render the ramifications of the system complete in England. The grand link connecting Scotland—will there not be two?—is yet wanting in the chain. Ireland is as yet untouched—would not a good system of internal locomotive communication go a long way to improve the civilization and better the condition of that unhappy and distressed country? This would be, indeed, desirable, if only for its moral and social effect. And is not her soil as capable of sustaining rails, and yielding profit too, as any other land? And we do think that, could the government overcome its present difficulties, and improve the revenue, it would do well to assist a spirited public in their meritorious desire to form a thorough railway connection throughout the entire kingdom, at least in such cases as presented ostensible means of remuneration for invested capital. It is true the public were too prone to believe, at the commencement of the railway mania, that in committing their money to the coffers of the company, it was to be multiplied to the unwarrantable height of their expectation; but their too sanguine anticipations were disappointed, and sad experience begat caution—we hope not discouragment; for it was not likely, upon contemplation, that an impetuous torrent, the characteristic of early railway speculation, bursting from its source, could dash on in its headlong course without meeting, at no very remote period, with some counteracting agency—some impediment to its success.

Now, when we meditate on the crowded state of the avenues to all descriptions of avocations for the last few years, we cannot feel astonished that, upon the introduction of a comparatively new profession, as engineering, public attention should be diverted into a fresh channel, and seize with avidity upon one holding out such promising advantages. At this period, too, there were comparatively very few men who had been really trained to the profession; numbers, however, upon ascertaining the necessary qualifications, went vigorously to work—but then time was an essential requisite to collect *materiel*; and in the interim a body of men, termed surveyors, possessing a tolerably good knowledge of their business, with a smattering of a few properties bearing some analogy to this branch of engineering, availed themselves of the opportunity, managed to get employed (for want of better substitutes) in some inferior capacity at first, until gradually acquainting themselves with a few of the details, arrogated to themselves the term of "Civil Engineers;" and before the genuine pupil had matured his education, these men had obtained, and do now hold, several of the best situations in the service. This incident will doubtless explain why there have been, and are, so many intelligent articled pupils out of employment; and it is a known fact that many have left the profession, their patience quite exhausted. Again, did the younger scion of a respectable family, in the innocence of boyish delight, sketch *anything* resembling a steam-engine, the anxious parent felt persuaded "the boy was a genius," and only required to be educated as an engineer to develop extraordinary talent. A great number of these geniuses, however, soon finding that engineering to be properly understood was no easy matter, floundered on for awhile, and at length gave it up as a hopeless business. Nevertheless there were many, having endured much tribulation, passed the rubicon, and thus swelled the numerical strength of the profession. It would appear, therefore, from the preceding analysis, that whilst the demand was falling off, the supply of *bona fide* engineers and self-entitled adventurers were increasing in a formidable ratio. The present aspect is, consequently, gloomy enough, but there is this satisfaction, if it be any, that, being at the bottom of the wheel, the next change will, in all likelihood, brighten the prospect. Upon reviewing the system of railway policy abroad, we cannot but advise the matured pupil to strive hard for employment at home before seeking it elsewhere; for Englishmen are not treated on the continent with that good feeling and generous acknowledgment of their worthiness to which they are justly entitled. There is likewise much jealousy existing amongst the French, and it almost invariably happens that such English engineers as have been led by promising hopes to enter into engagements have, upon a short trial of their continental neighbours, found their position so unpleasant as to cause resignation of office, if possible, and in default of that, to put up with much unmerited insolence, or have been unceremoniously discharged at the immediate expiration of the articles of agreement, but not before their wily superiors (in office, not abilities) have taken good care to reap a rich harvest of experimental knowledge from the solid acquirements of their *employés*. Many there are too, wearied with long inactivity, and despairing of obtaining situations in their own country have turned their attention to colonial prospects. But here, we fear, they will fall far short of their expectations; for the present condition of our colonies is not of that settled or flourishing nature as to favour the designs of the accomplished engineer. The fact is, a country must be in a tolerably advanced state of civilization—must possess extended commerce, internal trade—must have substantial resources of its own, and contain a strong body of capitalists devoted to the execution of public work, before it can be pronounced in a fit state to admit of engineering operations with any hope of success.

It is true a few *surveyors* may meet with encouragement in the more recent settlements of New Zealand and thereabouts, to head the exploring staffs in plotting out the ground for future emigrants, and there is no doubt of the existence of certain districts in America (especially the more southern parts) where the mechanical department might be carried on to a very profitable extent. But then what man is there, without some very definite plans for, and sure prospect of speedy success, a voluntary exile from father-land, and the comforts of home, with all its cherished attractions, could embark his living in such truly *outlandish* speculations. What are we to do then, is the general and anxious inquiry. Wait patiently, till the tide of fortune takes a more favourable turn, which we hope is not far distant. There is much left to be done in old England; and could the country once again recover from the depressed state, under which withering influence it has so long laboured, there is no doubt that engineering, like all other avocations, will quickly resume its former activity, and then every properly constituted member of the profession will meet with his due share of employment.

AN ARTESIAN WELL IN THE SEA.—An attempt is now being made at Brighton, to obtain water from beneath the chalk under the sea. The operations for this purpose are being carried on at the head of the chain pier, and it is confidently expected that the strata of chalk at this spot does not exceed 70 feet in thickness, through which, on arriving at the green sand, a constant unfailing supply of pure water is anticipated.

ROYAL ACADEMY.

Professor Cockerell's Lectures on Architecture.

(From the Athenæum.)

The Professor began by quoting the regulation of the Royal Academy as to the Lectures on Architecture—"That the Professor shall read annually six public lectures, calculated to form the taste of the students, to instruct them in the laws and principles of composition, to point out to them the beauties and faults of celebrated productions, to fit them for an unprejudiced study of books on the art, and for a critical examination of structures." It is understood that these lectures were to be given by a Professor in the full practice of his profession, according to the dictum of Vitruvius, "that it is the union of the practice with the theory, that makes the sound architect"; and although he felt that it was precisely this circumstance that gave all the value in the eyes of the students to these lectures, yet it was obvious that in the midst of the distractions and bustle of professional practice, the Professor laboured under great disadvantages. It was much to be desired that the means at the disposal of the Royal Academy could enable it to extend these lectures according to the model of the French Academy, which, on architecture alone, had established five classes, each having a separate professor,—namely, 1, Theory; 2, History; 3, Mathematics; 4, Stereotomy and Construction (in which important class two *Repetiteurs* were appointed); 5, Perspective. Such liberal instruction secured the honour of the profession, and protected the public against empirical practice; and gave the French architects, in particular, that advantage in foreign countries, which the unassisted genius, perseverance, and enterprise of our own countrymen found it difficult to contend with. Aware of this mortifying inferiority in our public education, the students would exert themselves so much the more in their private studies to supply the deficiency, and would learn from this well digested system the course they should pursue. This Academy had, indeed, been founded by an illustrious prince (George III), and great were the obligations of the arts and the public to his memory; but the means by which it existed were of its own creation, and those means were barely sufficient to fulfil its engagement, to support gratuitously the only school of art which this country possessed.

It is an axiom with the civilized nations of the Continent, that the fine arts are eminently calculated to increase human happiness and exalt human character, and greatly contribute to the reputation as well as the real interest of a country, especially of a manufacturing country.

But the austere government of England makes the fine arts no part of its glory, its policy, or of its expense. And were it not for the sympathy and patronage of the public, even this limited institution could not exist; nor would the country escape the reproach of the Celestials of "outer barbarism." The fine arts have, indeed, the countenance of the supreme head, and of "the powers that be"—the Ministers of the day, who cannot, as gentlemen, renounce the attribute of taste; but they have uniformly shown by their public conduct, that they do not consider its support amongst the people a political duty.

It is now more than a hundred years that Thomson, the best informed upon the arts of all our poets, indignantly remonstrated on our national inferiority and neglect of this branch of intellectual culture, and complained with grief, in his Ode to Liberty—

> "That finer arts (save what the Muse has sung,
> In daring flight above all modern wing,)
> Neglected droop their head."

Foreigners have attributed this disregard of the rulers of an ingenious and a great people to various causes—to physical insensibility, to the sordid nature of our commercial habits, or the adverse propensity of the Protestant religion—to which objections the history of the ancient dynasties of this country (never inferior in the fine arts), the abundant enthusiasm of individual artists of our own times, and the public sympathy, are direct contradictions. Finally, they have fixed the reproach on the government, by pointing at the Schools of Design established by parliament; for they say, truly, that so soon as the inferiority of our design in manufactures drove us from the foreign markets, we took the alarm, and immediately formed schools of design, *à l'instar* of those on the continent; not from a generous love of art, but, confessedly, from the well-grounded fear of loss in trade. The members of this Academy hailed the measure with joy, as the harbinger of a better sense of what is due to our intellectual position in Europe, and they have willingly given their gratuitous attention to its conduct. But the instruction of youth must be accompanied with the higher prospect of employment and honour in national works; and we are happy in the reflection that the decoration of the parliamentary palace at Westminster, and the interest taken by an illustrious personage in that great object, hold out to us the hopes of equality at least in these noble studies with the improving countries of the continent, and the opening of a new career for genius and industry.

But an erroneous and mischievous scepticism as to the utility of Academies of fine art altogether, has long been fashionable, which has not, however, been applied to others, for no one has ever yet despaired because a Newton or a Locke are not annually produced from Cambridge and Oxford; but of these it has been plausibly said, that no Michael Angelos, Raphaels, or Palladios have been produced by them since their foundation in the 17th century; it is forgotten, however, that the patronage and immense employment which elicited the talents of those masters, have also been wanting; and that without the field for their development, and all the expensive machinery by which they can be brought to bear, Academics can do little more than preserve and transmit the rudiments of art.

Fleets and armies are necessary for war, and without these the greatest captain of his day might have been nothing more than an eminent professor at Sandhurst.

Academies were established as depositories of learning and practice in the fine arts, and the means of their preservation and transmission through the vicissitudes of the times. The enlightened and commercial Colbert had seen how in Greece and ancient Rome, and in modern Rome, under his own countryman, the Constable Bourbon, a public calamity might disperse and ruin them for half a century, without some fixed and corporate body and abode. He never dreamt that, in the absence of the fostering patronage and employment of government, the Academy could do more than fulfil these negative objects. The Royal Academy had done much more than this—it had sustained the credit of the country in fine art, and had reared talents which were now part and parcel of English history. Through good and evil report it had nourished the flame; and it was consolatory to find that they had transmitted it to better times, through long and adverse circumstances; for now they had the happiness to see two Professors in the Universities of London, the British Institute of Architects, large public patronage in Art-Unions, &c., and a growing interest in the Universities of Oxford and Cambridge towards fine art generally.

But Architecture, as a science dignified by an intimate connexion with the exact sciences, and by her acquaintance with those eternal laws of mathematics and of physics which are obeyed throughout the universe, was, in this Academy, regarded only as a fine art, and these lectures were designed to illustrate Architecture in that capacity alone. Dealing with the phenomena of beauty and ideality in the form and aspect of her contrivances, she becomes an essential member of the fine arts, the more essential since her conclusions are more undefined and remote than any other branches of the fine arts, save Poetry and Music, with whom her nearer relationship than with painting and sculpture, is sustained by many. But in all that respects the beauty of forms and their combinations, she must never forget her obligations to her sisters painting and sculpture, by whose aid alone she becomes the *ars regina*, and keeps in view her prototype, Nature, ever equally solicitous of beauty and of use. And the moment she declines their counsels, her proportions become anomalous, and she descends to the mere building art.

In Egypt, where painting and sculpture were in comparatively small esteem, and again in the middle ages, proportions were wholly capricious, and subject to no order or regularity; nor have any been ever attributed to them even by the greatest admirers of Egyptian or Gothic architecture. On the contrary, the Greeks, aided by the union of the three arts, soon established that analogy with the organized productions of nature, which fixed the proportions of architecture in so determinate a form as not to be safely departed from, and which, whether in the days of Phidias, or Raphael and Michael Angelo, or any other renowned period of art, has been approved and adopted as just and incontrovertible.

The fulfilment of the duty of the Professor under a limited number of lectures, had been a subject of some anxiety and difficulty. The history of the art was the only safe foundation of the study, and had, therefore, formed his first course. "Architecture," says Sir C. Wren, "is founded on the experience of all ages, promoted by the vast treasures of all the great monarchs, and the skill of the greatest artists and geometricians, every one emulating each other. And experiments in this kind being greatly expenceful and errors incorrigible, is the reason that architecture is now rather the study o antiquity than fancy." With respect to the duration and progress of this art, it might be said that a hundred years were but as a day; being made for ages, it could not, therefore, be subjected to the vicissitudes of fashion; and the slowness of its progress and invention ought to inspire us with respect for antiquity and the authority of example, and to repress that presumption which too often assumes to dispense with them.

In fact, at every epoch in which the art had raised itself to its highest conceptions, we find not only artists but theoricians, archæologists, and historians, occupied in describing its progress and inventions, illustrating its monuments, and seeking out its antiquities. There are many histories of architecture more or less complete; Canina's work promises to supply the history of ancient architecture which Winkelmann had left very insufficient. D'Agincourt's "Histoire de l'Art par ses Monumens" was an admirable work; it treated of the art from its decline to its revival and restoration. Durand's "Parallel des Edifices anciens et modernes," on the same scale, is highly illustrative of the history of architecture.

The second course (that of last year) had treated chiefly the literature of the art; following out the Academic instruction quoted above, namely, "to fit the students for an unprejudiced study of books in the art." It had been well said by a learned prelate, "that we do not live in an ignorant age, but certainly not in a learned one;" and it was painful to see those authors who had been canonized by ages, either attacked and discredited, as Vitruvius, or held to be antiquated and obsolete, as the old Italian and French authors, and above all, the admirable Alberti, the Bacon of the art, and others of the greatest interest. The obvious consequence was, that new lights, fashionable conceits, and heretical opinions, were conducting us into the large ocean of error. As well might the lawyer or the divine dispense with books as the

architects. In the very dawn of literature the architect was required to be learned. In the Memorabilia of Xenophon, Socrates inquires, "But what employment do you intend to excel in, O Euthedemus, that you collect so many books? Is it architecture? for this art, too, you will find no little knowledge necessary."

A familiar example of the great utility of these researches had been given in the quotation from Philibert de l'Orme (lib. ii. c. xi.), of the specification for concrete, written in the latter part of the sixteenth century, and corresponding precisely with the recent so-called discovery of this method of securing foundations. During the last century our architects had discontinued the ancient practice, having adopted the most fallacious fashion of wood-sleepers, to the ruin of many fine buildings. It was, then, the ignorance of this invaluable and most instructive and amusing author, Philibert de l'Orme, which had led to so fatal an error.

With reference to Vitruvius, the commentators, in forty-one editions, since his discovery in 1416, were shown to have made but slow progress, and to have done the author but little justice; and ever since the uncandid Schneider had published his edition in 1807, ten important discoveries, illustrating the correctness of his theories, had been made by modern travellers and architects.

In the present course the Professor purposed the consideration of the more difficult, but no less important, injunction of the Academic regulation, "that these lectures should be calculated to form the taste of the students, to instruct them in the laws and principles of composition, and fit them for a critical examination of structures."

Those laws and principles which are technical, were often treated, and were more obvious; but those which constituted architecture a fine art, were more subtle, but not less vital, to those who aspired to the higher attainments of the art, namely, the sublime and beautiful. Such inquiries had employed the most learned and ingenious minds in all ages; and although theories are proverbially dangerous things, and must be treated with great caution, yet, recommended as they are by the authority of great names, they ought to be known and discussed; effects attributable to right reason and right feeling are essentially subjects of discussion, and the old proverb should be reversed, and "De gustibus disputandum est" should apply to all those preferences which depend on reason, and not on sexual or fanciful arbitrament; and though the inquiries into the æsthetical of art, which have occupied the last century particularly, fall short of the results we should desire and expect, and that after all genius alone can rightly solve these questions, which elude common sense, yet we may cultivate and improve our critical powers, learn to think more accurately, and correct that colloquial laxity of speech which refers all impressions to some cant phrase of undefined signification, as *fine* and *beautiful, tasteless*, &c.

Such investigations afford the only means by which the principles of this or any other art can be ascertained, and the artist can be enabled to determine whether the beauty he creates is temporary or permanent, whether adapted to the accidental prejudices of his age or to the uniform constitution of the human mind; and whatever the science of criticism can afford for the improvement or correction of taste must altogether depend upon the previous knowledge of the nature and laws of this faculty.

In the following lectures the Professor proposes to review the examples cited in his former courses with reference to these important principles.

Lecture II.

The Professor said, that the developement of the human faculties was exhibited in the history of Architecture under its most favourable aspect. The art might be termed the epitome of of civilization, the first fruits of social order and combination, of every discovery in science, and of every conception of beauty. Political history was of comparatively inferior interest, and betrayed, for the most part the depravity of our species. The natural labours of man, those of agriculture, or commerce, their unvarying succession, brief endurance, and disappointment, leave melancholy convictions; but in the occupation of architecture, man finds the employment of those higher aspirations and idealities for which he feels himself born, as well as of his physical energies. Here he perceives that he has a soul; all his loftier conceptions—order, calculation, beauty, and immortality—are opened to his contemplation, and he seems to feel the power of extending his works and his memory beyond the bounds of nature and of time.

The exhibition of these innate and physical capacities seems to be his natural desire; and the progress of his operations coincides with his intellectual growth. In his boyhood he contends with the forces of nature; he moulds the vast rocks, and rears on end the monolithic obelisk; or, accumulating the masses with laborious endurance in the pyramid, he emulates the works of Nature herself; and exulting in the force of order and combination, and his acquired skill, he exclaims, with the Babylonians, "Go to, let us build a city and a tower, whose top may reach unto the heavens, and let us make us a name." Add, although in our advanced civilization, we may smile at the superfluity of such labours, we must not forget that by them man first vindicated his capacities, and that metallurgy, mechanics, and all the manual exercise and discipline which fulfilled his apprenticeship to civilization, were brought into practice, which soon employed itself in more intrinsic benefits.

The age of Alexander and the Romans abundantly illustrated this truth. Man now contends with the elements. The ocean is curbed by his ports and quays, and Pharos; he sails across its bosom; marshes are drained; sewers, canals, aqueducts, and roads, exhibit the mastery he had acquired, and his conquests over nature. Frontinus, whose work on aqueducts was written about the year 80, has a passage remarkably illustrative of the growth of this spirit in his time. After giving a description of the nine aqueducts under his care, brought to Rome by successive labours, making an aggregate length of about 112 miles, he exclaims, "with so many waters, and so many magnificent works necessary for their transport to this great city, will you compare the idle Pyramids of Egypt, or even the inert works of the Greeks, however celebrated and glorious in his ory?" The ingenuity of the architect now, therefore, issues to use, and through 1800 years it is more or less subordinate to it, either in the great business of religious and moral improvement in the building of churches, or the security of civil life in castles and mansions. Finally, in recent times, it is contracted to absolute utilitarianism, and all its powers are bent to the perfection of the individual dwelling between party walls, in which every subject of the state is in the enjoyment of personal luxuries and conveniences of life unknown to the Pharoahs, the Medici, or the magnificent Louis the Fourteenth.

Thus, as Monsieur Guizot finely observes, each age and nation seems to have flourished for some beneficial purpose to Mankind, which, being accomplished, it disappears from the stage.

The history of architecture may be said to divide itself into five classes—Sacred, Civil, Military, Domestic, and Monumental. In the accompanying drawing (a roll about twelve feet square, containing a vast group of buildings inscribed within the outline of a pyramid, on a large scale) are seen indiscriminately some of the principal monuments of all these classes (except the military), comprising a period of 3,331 years. We may say to the students, in the words of Napoleon to his troops, before the Pyramids of Gizeh" Quarante siècles vous contemplent!"

This arrangement done under the Professor's direction, about twenty years ago, appeared, he believed, for the first time in the Penny Magazine. A comparative view of the great buildings of the earth, on the same scale, might minister to that false estimate of merit, which is derived from material dimension; but that criterion would vanish before the comparison of renown; and the Parthenon, and other small buildings, here represented, would abundantly illustrate the preference to be awarded to

The little body, but the mighty soul.

National attachment might excuse his pointing out the spire of Old St. Paul's, the only one exceeding the height of the Great Pyramid. Those of Mechlin and Cologne, though designed to have exceeded it, remained imperfect. A limit seems to be placed to man's arrogance and vain glory. We were taught, like the Babylonians, that the God of nature delights not in the accumulation of his favours and his light, and isolated in single spo[t] but in the wide-scattered communication of them throughout all lands.

But the observations already offered, were illustrated still further by sections [on a roll as large as the former, showing the structure of the mo[st] important temples, on the same scale.] The issue of the art in use an[d] economy, was most remarkably shown in the comparison of those sections, in which we observe, that St. Paul's displays the largest bulk with the least material, hitherto contrived.

He should now call the attention of the students to two rolls [about 16 feet long each], in the first of which the plans of the remarkable temples of the ancient world, from the Tabernacle in the Wilderness (1491 B.C.) to the reception of Christianity (313 A.C.), and in the second those from that epoc[h] down to 1842, were all laid down to the same scale. There was displayed, as it were, the genealogy of temples, during 3330 years.

It was sacred architecture which he purposed to review cursorily that evening; and short enough was the time for a subject so deeply interesting; indeed, such an expression might be deemed presumptuous; and it was obvious that we should be enabled to do no more than pass the plans in review, and remark upon those characteristics which became the more palpable on the synoptic view of centuries and ideas of such extent and variety; and which were less frequently commented upon. It might be objected by the students that subjects of such vast scale and importance and rare occurrence should be illustrated, rather than the more practical; but we should remember the dictum of Vitruvius, that the architect ought to pursue his studies "maxime in ædibus Deorum, in quibus operum laudes et culpæ æternæ solent permanere." In fact, the remains of these precious exemplars of skill and cost and labour, the types of our art, were still discoverable even from the most remote times, as if Nature herself, as well as man, had respected them.

In approaching sacred architecture, and in discussing the technical considerations of the forms and structures of temples, we cannot but bow with respect and veneration to those motives and affections, the noblest of the human heart, which have ever urged these sacrifices to the mercy and the majesty of the Creator—and we recognize in the Grecian or the Druid, the Hindoo or the Christian temple, the universal sentiment so finely expressed in the Psalms, CXXIX.—

"Lord, remember David and all his trouble!

"How he sware unto the Lord, and vowed a vow unto the mighty God of Jacob,

"I will not come within the tabernacle of mine house, nor climb up into my bed,

"I will not suffer mine eyes to sleep, nor mine eyelid to slumber, neither the temples of my head to take any rest,

"Until I find out a place for the temple of the Lord, an habitation for the mighty God of Jacob."

In excavating the foundations of the temple at Ægina, the remains of burnt woods and bones of sacrifices were discovered, mixed, no doubt, with libations and tears and aspirations as warm as those of David;—at Selinus we find the steps in front of one of the temples worn down almost to an inclined plane, by the feet of the devout. So again of the accomplishment of these vows amongst men of all ages and nations, we shall find the most solemn and full expression in the eighth chapter of the First Book of Kings, the dedication of the temple by Solomon.

The resemblance of the plan of the Tabernacle in the Wilderness, and with its surrounding court (the first in our series, B.C. 1491), and still more, of the temple of Solomon; with the arrangement of the Greek and Roman temple, down to the Antonines at the end of the second century of our era, is very remarkable. In the first the parallelogram is preceded by a portico of an irregular number, namely, of five columns. In the second (1012 B.C.) we have the temple in Antis.

If we enter into particulars, we are still more struck with their correspondence; we find for instance, the irregular number in the temple of Jupiter at Agrigentum one of the largest and most important of antiquity: seven columns compose the front; and we are reminded of Solomon's saying, (Prov. ix.) "Wisdom has builded her house, she has hewn out her seven columns." Again, at Pœstum we have a temple (miscalled a basilica) with nine columns in the front. Other examples also might be cited. Again, of the Temple of Solomon, that of Themis at Rhamnus, and the frequent temple in Antis, with its pronaos and heiron, is the constant copy. The altar of sacrifice, that of incense, the laver, the table of shew-bread, are all traced either in existing remains, in bas-reliefs, or in medals.

The connexion of classic and sacred architecture is thus apparent; and the author of "The Plagiarisms of the Heathen Detected," (Mr. Wood, of Bath,) is borne out in this comparison of the *plan and arrangement* of temple architecture. The common error (and one to be carefully avoided) is the attempt to trace this resemblance in *the styles*, or the ichnographic figure of the parts and orders—the mere vesture of the scheme; and the failure in straining the texts and examples (Corinthian or Doric) to a perfect correspondence, either in Wood, Villalpandus, or his learned predecessor, Wilkins, has always thrown a doubt upon these interesting investigations; but the comparison of the *plans* makes the Tabernacle the type of the Greek and Roman temple, a work which Paul as well as Moses assures us was inspired by the Deity, "for see, saith he, that thou make all things according to the pattern showed thee in the mount." (Heb. viii.)

It is remarkable that the earlier or contemporary works of Egypt show no similar arrangement; nor was it likely that Moses should adopt and recommend any form associated with Egyptian recollections. The circular form of plan is indeed traced in Greece, and Rome more especially, and amongst the Druids, but the most frequent by far is the parallelogram, after the Tabernacle: in fact, the earliest inhabitants of the bordering countries were apparently monotheists; their connexion with the Jews through Tyre and Sidon, their respect for a people of superior knowledge and religious instruction, may well have sanctified their form with them: the ritual was the same with them; the idol took the place of the ark; with both, the temple was the Domus Dei; both were religions of sacrifice.

The ritual was thus the originator of the form of the temple, and must always be so. The temple in Antis became (with a view to ornament, and by the successive inventions for decorum and dignity) the prostyle, peripteral, dipteral, and pseudo-dipteral. The much-boasted beauty of the Greek temple was not, then, an invention of taste, but one of ritual; and in the consideration of templar architecture, in all times and countries, this important fact must be carefully borne in mind.

Another point of resemblance of classical and Jewish architecture, of great import, since it is the hinge upon which the whole system of ancient architecture turns, is the employment of "costly stones, even great stones, stones of ten cubits, stones of eight cubits." Upon this practice the whole character and taste of sacred and classical architecture depends. The tenth book of Vitruvius treats chiefly on large stones and their transport. The type of Domus Dei admitted of no extension; the only mode of giving magnificence and dignity to temples, thus circumscribed in form and composition, was by the employment of monolithic masses, and by the exquisite detail of proportion, order, and sculpture bestowed upon them. The ancient world is full of examples of this remarkable principle, and the last and most signal one is that in the temple at Balbec, by the Antonines, in which three stones measure, in the aggregate, upwards of 199 feet in length.

The Saviour, whose religion was soon to supersede all ancient laws, constantly illustrates his arguments by this practice: "the head stone, the chief of the corner, which the builders rejected," are his constant metaphors; and his prediction that of these great stones "there shall not be left one upon another," is literally verified in the subsequent history of Architecture.

Our remarks upon the uniform arrangement of plans of Greek and Roman temples, would be too long, and must be referred to the publications upon them specifically; but as brought together in this view it may be observed, that the temple at Ephesus, the size of which we learn alone from Pliny, exceeds all others in dimensions, and the constant limitation of length of the great temple to Jupiter especially (at Athens, Agrigentum, Selinus, Balbec, and Rome) to about 358 feet in length, might lead us to suspect the text of Pliny. Vitruvius gives us a few hints of the attachment of the ancients to numbers in his third book, with reference to the dimensions of temples. The investigation of this subject might be attended with curious results. The frequent dimension 358, by the addition of the stylobate, or by the local variation of the foot, may easily be supposed to refer to the number of days in the solar year. In the Temple of the Sun at Palmyra, the portico has 12 columns; these, added to the columns in the temple, make 52; the whole number of columns in the surrounding peribolus, is 364. Wren seems to have had reference to this idea in his height of St. Paul's.

The sections of Ægina, the Parthenon, and the temple at Pœstum, exhibit the arrangement of an interior divided into a nave and two ailes, by two rows of columns in double heights; those of Venus and Rome, and Balbec, exhibit the Roman form, namely, a vast vault—in these instances, upwards of 60 feet diameter in masonry. The occupation of the whole of these interiors by the idol, their employment as a vast niche to receive the god (in ivory and gold, at Olympia and Athens), had something of monstrous, but magnificent; and invested with the art of Phidias, we may understand how even the rough soldier, Paulus Æmilius, might be moved even to tears, as we are told, in the presence of the beauty and majesty of the godhead, as figured by that great master.

Arrived at that period (313 A.D.) in which the Christian religion was adopted by the state, the range of temples now exhibited displays a total reverse of the previous arrangement. The old ritual of external worship and of sacrifice was abrogated. It was now internal and of the heart; the portions were now inclosed; a vast area covered with a roof, of which the basilica was the best model, constituted the Christian temple. Upon this the cruciform was engrafted, "in hoc vince," bearing the universal symbol, in plan as well as in every other situation. The theory of the church of Constantine is handed down to us by Eusebius, bishop of Cæsarea; he describes the church of Tyre (which the Professor exhibited) and many others of his day, with the most interesting and instructive hints as to the signification and arrangement of sacred edifices, which may be very profitably consulted by the architect. The basilicas of St. Peter's and that of St. Paul's at Rome, in the form of the Latin cross, become the types of the Christian church throughout Western Europe, with very small variation (until the introduction of the dome, which then only modified it), down to the present day.

It was said that 1800 churches and religious structures were built during the reigns of Constantine and Justinian: those of the former were in the basilica form, which is liable to decay; those of the latter, to which the ritual and other important considerations gave a new form, resembled the Greek cross of equal lengths. The transept was covered with a large dome, and the ends of the cross with minor ones, forming a group highly favourable to architectural effect. This form, executed in Santa Sophia, became the wonder of the world, and the dome also, 120 feet in diameter, exceeded any executed since the Pantheon at Rome.

The Professor exhibited several Greek churches at Arta, Thessalonica, and other parts of Greece, measured by himself, as also the valuable researches on the Greek church architecture of the sixth and seventh centuries, by M. Couchaud, which contained many hints of great beauty and interest to the practical architect. The churches of Russia were all upon this plan. Procopius was the author, who might be consulted with reference to this era of the art.

The dome, which had become the distinguishing feature of the Eastern church, penetrated into Italy, under the exarchate at Ravenna, in the church Santa Vitali, 510 A.D; and again at Venice, in St. Mark's, built by a Greek architect (976—1071). Until the eleventh century, the dome formed no part of the western church, except in those instances; it was then that the Pisans, the richest and most commercial people of Italy, began their great church (1063), and adorned the transept with this new feature.

The rivalry of nations is the great fulcrum of many a noble effect, in arts as well as politics; and to this motive chiefly, we may attribute the bold scheme of Arnolpho de Lapo, in the church of Santa Maria, at Florence, founded in 1290; in which, doubtless, after the model of the Pantheon, he proposed to place a dome, of nearly equal magnitude, over the transept, but raised into the air in a way hitherto unattempted, except at Constantinople, where, however, the space was one-sixth smaller. But the inveterate and disastrous contests of these republics long deferred the execution, and it was not till one hundred and twenty years after, that Brunelleschi accomplished the work, as related in the very amusing and instructive account by Vasari.

It was just one hundred years after this successful work that Michael Angelo executed the dome at St Peter's, confessedly in imitation of it, as he told himself, in contemplating the model—

Vó far la tua sorella,
Piú grande giá, ma son piú bella.

In another one hundred and fifty years, we have the Domes of the Invalides, Val de Grace, at Paris, and St. Pauls, in London.

The family of Domes concludes with that of St. Genevieve (the Pantheon), and, like the successor of a noble but a worn-out race, exhibits all that meagreness and debility which precedes its extinction.

But the imitations of the types of the basilicas of St. Peter's and St. Paul's of Rome in the north and west of Europe,—*more Romano* to the eleventh century, from the eleventh to the sixteenth centuries *more Germanico*, by the societies of Freemasons,—have justly been the admiration of the world, for

their unexampled hardihood and practical science, though the remarks on their principles of structure and of art, which the future lectures will have occasion to offer, will show that neither the geometrician nor the scientific architect need regret the impenetrable veil which conceals them. Any detailed discussion of the merits of the plans exhibited would lead beyond the bounds prescribed; but we must admit that, generally, the continental plans exceed our own in magnificence of design, especially in the double ailes and the western fronts. To what causes may be assigned the more modest design of our own churches, except to that characteristic prudence of our countrymen, which requires the full accomplishment of every enterprise undertaken, it may not be easy to determine; certain it is, that all the churches of this country are complete in their design and features, whereas those of the continent are very rarely so.

The words of our poet, though not always applicable to architects, unhappily, may be so to our pastors and masters.

> When we mean to build, we first survey the plot,
> Then draw the model: which if we find exceeds ability,
> What do we then, but draw anew the model in fewer offices.
>
> ——— Consult surveyors, know our own estate,
> How able such a work to undergo.
> Or else we build like those, who half thro' give o'er,
> And leave their part created cost
> A naked subject to the watery clouds,
> And waste for churlish Winter's tyranny.

With reference to the gradual verticality which the sections of this series of ancient and modern temples assumed, we might say, that the earliest were of the earth earthy, and the latter as sublime as the religion for which they were designed. Thus, the height of the Pantheon, at Rome, was equal to its diameter, or as 10 to 10; that of Venus, and Rome, was as 12½ to 10; that of the Baths of Caracalla, as 14 to 10; of St. Peter's, at Rome, as 17 to 10, of St. Paul's, London, 20 to 10, as also of Lincoln, and that of Cologne was as 34 to 10.

The last great temple of Christendom, was the Magdalene Church at Paris; it is 325 feet long by 136 feet wide and 120 feet high, and equalled the smaller temple at Balbec. It was the work of more than half a century. In England, great activity had been used in church-building during the last twenty-five years, but the warmest admirers of those zealous efforts could never pretend that any regulated architectural spirit has directed those works. No church of a monumental character had been attempted. The ascendancy of the high church party is, however, favourable to our art, and it is not unlikely, that under good direction, it may flourish in a few years. But there is much pedantry abroad, and an absence of all originality and intrinsic character in the taste of the day, which leans to the Roman Catholic form, the basilica, suited to a demonstrative form of worship, rather than the auditorium required by our ritual. Veneration for antiquity is to be respected and encouraged, but its transition to superstition is easy. The divines of 1680 have left us models, erected under the direction of Sir C. Wren, which have not been surpassed. Seven of the city churches were exhibited (measured by the Professor), which would be found as remarkable for their adaptation to our form of worship—offering the largest area, with the smallest obstruction to the sight and hearing—as they were ingenious and admirable in taste and structure.

The favourite design of Sir C. Wren (laid down from the model now in St. Paul's,) was also exhibited. It was a precious legacy to posterity, which had never been surpassed in architectural beauty and arrangement, for the Anglo-Protestant Cathedral church, and would probably at some future time be executed.

But attachment to our national architecture may be indulged with great propriety by the adoption of the forms of the Lady Chapels, modified and suited to our ritual—as those of Wells, Ely, and others; or of the chapter-houses; and the Greek church. The basilica form requires length unsuited to our services, and the fragments or curtailed portions of that form, often practised with small success in our recent churches, seems to point at the greater advantage of the vertical arrangement, which the models, the Professor ventured to suggest, in the churches of Wren, and the examples quoted, would assure to us.

THE METROPOLITAN PAVING ACT.

An important case came before Mr. Hardwick at the Marlborough Police Office, on the 24th of December last, arising out of a dispute between the Equitable Gas Company and the Commissioners of Paving for the parish of St. James's, Westminster, as to whether the Equitable Gas Company had or had not the right of breaking up the street and afterwards lay down a service pipe "without the consent of the Paving Board." After hearing both parties, the Magistrate adjourned the case for consideration until Thursday, January 5th, when it was again heard for final adjudication.

Mr. Smith, solicitor, attended on behalf of the Paving Commissioners, and Mr. Clarkson, the barrister, for the Equitable Gas Company.

Mr. Hardwick read the following as his opinion:—This is a complaint by the Board of Pavements, in the Parish of St. James, against the Equitable Gas light Company, for breaking and taking up the pavement in their jurisdiction for the purpose of laying down a new pipe without the consent of the board. The answer of the Gas Company is, that it being a service pipe and not a main pipe, a notice only and not the consent of the board is required. The clauses which gave rise to the disputed point are in the 11th section of the 57th George III, cap. 29. Abridged they stand thus—"No water or gas light company shall break or take up the pavement in any street for the purpose of laying down any main or mains of pipes, unless notice in writing be given to the surveyor of pavements three days previous to such breaking up," &c. So far water and gas companies are placed upon the same footing; but in the next clause a further restriction is imposed on gas companies. By it no gas company can take or break up any pavement for the purpose of laying down any new mains or pipes without the consent in writing of the Board of Pavement. When my attention was first called to this clause, my impression was, that being, as it then seemed to me, in the disjunctive, the word "pipes" must be taken to include pipes of every description, and that the Board of Pavement was right in their view of the case. But on a more attentive perusal of this section, and especially of the following one, that impression has been much removed; and I am now inclined to think that the perplexity in this matter has arisen from an ambiguous use of terms, from using different expressions to signify one and the same thing; for example:—In the beginning of the 12th section, which directs of what materials mains should be, the language there used is worthy of observation. "That all new or complete mains, or pipes laid down in any street by any water or gas company, whether such new or complete main of pipes shall or shall not be substituted for, or added to, any other complete main or mains of pipes, shall be of iron alone." Here in these few lines we have three different expressions—mains, or pipes, main of pipes, and main or mains of pipes, all signifying one and the same thing—the main pipe. In the next clause separate and distinct mention is made of service-pipes, which may be either of iron or lead, or other durable material; from which I am induced to infer that, possibly, "or" is a typographical error for "of," or at any rate it is to be taken in a disjunctive sense, but, as it is frequently used, expressing an alternative of terms, a definition or explanation of the same thing in different words. Thus "main" being purely a technical word of the most comprehensive signification, the terms "pipes" and "mains of pipes" have been added and used as an alternative term to give it a clearer and more definite meaning for the purposes of this act, and therefore the expression "mains or pipes," in the clause under discussion, may not unfairly be read as synonymous with "mains of pipes," or pipes forming the main. If this should be the right view of the case, the complaint must be dismissed; as the pipe in question laid down is a service, not a main pipe, it requir[illegible]otice only, not the consent of the board.

Mr. S[illegible] argued that the 11th section of the act of Parliament related both to main and service pipes, whether they [illegible] for gas or water companies.

Mr. Hardwick said this question only applied to mains.

After a long discussion, Mr. Hardwick said he still adhered to the conclusion he had just read.

Mr. Smith observed, that unless there was a conviction before the magistrate, he had no power of appeal.

Mr. Hardwick said the proper court of tribunal was the Court of Queen's Bench.

Mr. Clarkson had waited very patiently while this discussion was going on. He was, however, very much surprised to hear that Mr. Smith had displayed so much ignorance with relation to the decision of those whom he (Mr. Clarkson) was proud to call his learned friends—viz., the present Attorney-General (Sir F. Pollock), or former Attorney-General (Lord Campbell), Mr. Adolphus, and another learned friend, all of whom had given opinions quite contrary to that which Mr. Smith now stood upon. He contended that the mains having been laid down at the house of any person applying, common law and common sense gave him the power, which the law of England gave every man, of having his own subsoil opened. He did not know whether it was, as the worthy magistrate had observed, a typographical mistake in the act of Parliament in substituting "or" for "of," or one of those tinkerings which he had so frequently observed in the machinery of acts of Parliament, but he must say the act was most defective. It was wind without sense; sometimes the word "mains" was used, and sometimes "pipes;" they were "*ejusdem generis.*" What a state of things it would be, if a collector was to come to a person who wished his gas to be laid on in the front of his house, and say he did not like his look; or, if another was to be asked to lay on the water, to say he did not admire his politics. Would such proceedings be tolerated? He was certain not. The tenant, the drains having been laid down, had a right to open the subsoil, and in his opinion he was fortified by the opinions of the eminent legal authorities he had mentioned. A similar case had been argued before Mr. Long by himself and his learned friend Mr. Bodkin, and the learned magistrate had, in that case, decided, notwithstanding all his learned friend's arguments, against him and the parochial commissioner.

A discussion was here raised between Messrs. Clarkson and Smith, as to whether or not notice had been given on the 11th of May by one of the inspectors of the gas company of his intention to open the street; Mr. Clarkson denied that such notice had ever been given.

Mr. Hardwick considered that, by the arguments which had been brought before him, and also by his own previously written opinion, the gas company were authorized to open the ground for service-pipes: the complaint was therefore dismissed.

REVIEWS.

An Encyclopædia of Architecture, Historical, Theoretical, and Practical. By JOSEPH GWILT. Illustrated by more than 1000 engravings on wood. In one thick volume, 8vo., 1080 pp. London, 1842. Longman & Co.

SECOND NOTICE.

WE may resume our notice of this work, by remarking that Mr. Gwilt indulges almost quite as much in criticism upon "critics," as upon buildings, and that as regards the former, he is apt to express himself with a degree of spleen against the whole race, that amounts to want of temper, and which certainly is not calculated to obtain for him their good word. Nevertheless, his present work has obtained unqualified, not to call it outrageous praise, from some of them; viz., those who write for newspapers, and in whose favour he is henceforth bound to make an exception. Most good-natured they certainly must be allowed to have shown themselves—that is, supposing they looked far enough into his book to meet with some of the ungracious reflections he has thrown out upon the fraternity of reviewers. Although not very thin-skinned ourselves, nor disposed to vindicate the pretensions of all our reviewing brethren, we must say, that Mr. Gwilt carries his hostility too far. He takes it for granted, that none of those who write upon architectural subjects in literary journals, are professional men, or if not belonging to the profession, can have qualified themselves by study, for the task they venture upon. Were the "catalogue of works on architecture," which he has given in his Encyclopædia, what it ought to be, it would contain many, and those not the least interesting or valuable of all, for which we are indebted to the studies of those whom Mr. G. would have us regard as little better than intruders and pretenders—persons who just know enough of the subject to assume a tone of authority, and mislead others. Since he has not thought proper to insert in that "Catalogue," such works as Hope's History of Architecture, Parker's Glossary, (now considered as a sort of authority,) and the publications of Rickman, Whewell, and Willis—not to mention others, which he has omitted; we must suppose that he estimates them not at all higher than the effusions of anonymous scribblers and reviewers, although they have obtained some character not only with the public, but with the profession also. What may be his standard of merit—where he has drawn the line between works that are, and those which are not worthy of being recommended to the student, we are unable to say, for he seems to be just as over-liberal and indulgent in some instances, as he is vigorous in others. Among the publications enumerated under the head of modern English architecture, we do not find the "Public Buildings of London," or Malton's "Picturesque Tour," which last, though not professedly architectural, as it contains only views, is an exceedingly interesting graphic work. Neither are Robert Adam's designs there mentioned, although those of James Lewis, a far less distinguished architect, are. Neither is Barry's "Traveller's Club House" inserted, notwithstanding that both the building itself is considered a tolerably favourable specimen of English architecture at the present day, and is more fully illustrated than almost any other individual edifice, excepting Holkham.

That these remarks are rather ungracious, and not likely to prove altogether palatable to Mr. Gwilt, we do not deny; but many of his own remarks are so exceedingly ungracious and illiberal, that he has no right to look for much forbearance on the part of others. Even while we are willing to give him credit for having the interests of architecture at heart, we think he has altogether mistaken the way in which they are to be promoted. Instead of expressing any satisfaction at finding that architecture now begins to excite far more attention than it used to do, he takes no pains to conceal his disapprobation of its being taken up as a mere pursuit, by those who do not apply to it professionally; which is almost tantamount to saying, that those who have a taste for the study, have no right to indulge in it, and to acquire that knowledge of the art, which is indispensably requisite, if they would really enjoy it, and become capable of judging of its productions:—which is certainly strange doctrine, and is so completely contrary to all views of sound policy, that, never, it is to be hoped, will it be adopted. Of that, however, we have little apprehension; were it ever so desirable, it is now too late to attempt to check what is, if not a rapidly advancing, a widely spreading taste. Far more reason is there to apprehend that the prejudices to which Mr. G. has given way, will raise up some prejudice against his own book: at all events, they are not calculated to obtain him good-will. And though on our own part we might have abstained from adverting to this characteristic of his Encyclopædia, we should have felt that by so doing, we were deserting the cause of architecture and its friends, and by our acquiescent silence, abandon many who have rendered important services to that cause, to the odium attempted to be thrown upon them by Mr. Gwilt.

To return to the volume itself: the more popular portion of it, namely, the historical, is by no means so full as it ought to be, and might have been, had space been obtained for that purpose, by omitting elsewhere a great deal of matter which there was not the least occasion to introduce at all. Of the architecture of many parts of the Continent, we meet with only hasty sketches, without any specimens of their buildings; and even the history of Italian architecture is cut short very abruptly, being brought down only to the beginning of the 17th century, as if the following and the present one had produced nothing of the least note. Yet some mention of Calderar and his works, if of no one else, might have been expected, from a professed admirer of the Palladian school, as Mr. G.

Of a work of this nature, it is hardly possible to convey a suitable idea by extracts or detached passages; nevertheless, we give those in which the characteristicts of the Florentine, Roman, and Venetian schools are spoken of, and respectively illustrated by an example.

"*Florentine School.*—Climate and the habits of a people are the principal agents in creating real style in architecture; but these are in a great measure controlled, or it is perhaps more correct to say modified, by the materials which a country supplies. Often, indeed, these latter restrict the architect, and influence the lightness or massiveness of the style he adopts. The quarries of Tuscany furnish very large blocks of stone, lying so close to the surface that they are without other difficulty than that of carriage obtained, and removed to the spots where they are wanted. This is probably a circumstance which will account for the solidity, monotony, and solemnity which are such commanding features in the Florentine school: and which, if we may judge from the colossal ruins still existing, similarly prevailed in the buildings of ancient Etruria. In later times another cause contributed to the continuation of the practice, and that was the necessity of affording places of defence for the upper ranks of society in a state where insurrection continually occurred. Thus the palaces of the Medici, of the Pitti, of the Strozzi, and of other families, served almost equally for fortresses as for palaces. The style seems to have interdicted the use of columns in the façade, and on this account the stupendous cornices that were used seem actually necessary for the purpose of imparting grandeur to the composition. In the best and most celebrated examples of their palaces, such as the Strozzi, Pandolfini, and others in Florence, and the Picolomini palace at Sienna, the cornices are proportioned to the whole height of the building considered as an order, notwithstanding the horizontal subdivisions and small interposed cornices that are practised between the base and the crowning member. The courts of these palaces are usually surrounded by columns and arcades, and their interior is scarcely ever indicated by the external distribution. From among the extraordinary palaces with which Florence abounds, we place before the reader the exquisite façade of the Pandolfini palace, the design whereof (Fig. 1.) is attributed to the divine Raffaelle d'Urbino. In it almost all the requisites of street architecture are displayed. It is an example wherein the principles of that style are so admirably developed, as to induce us to recommend it, in conjunction with the façade of the Farnese palace hereafter given, to the elaborate study of the young architect.

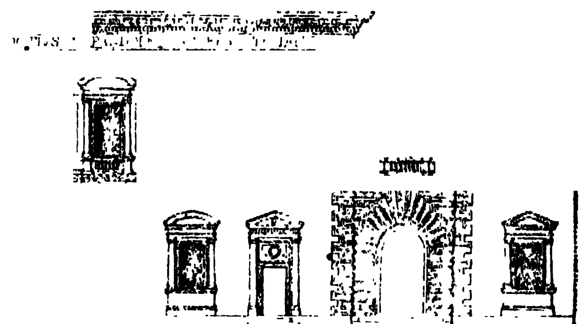


Fig. 1 PANDOLFINI PALACE.

"*Roman School.*—Though the city of Rome, during the period of the rise and progress of the Roman school of architecture, was not altogether free from insurrectionary troubles, its palatial style is far less massive than that of Florence. None of its buildings present the fortress-like appearance of those in the last-named city. Indeed, the Roman palaces, from their grace and lightness, indicate, on the part of the people, habits of a much more pacific nature, and an advancing state of the art, arising from a more intimate acquaintance with the models of antiquity which were on every side. The introductions of columns becomes a favourite and pleasing feature, and great care and study appear to have been constantly bestowed on the façades

of their buildings; so much so, indeed, in many, that they are but masks to indifferent interiors. In them the entrance becomes a principal object; and though in a great number of cases the abuses which enter into its composition are manifold, yet the general effect is usually successful. The courts in these palaces are most frequently surrounded with arcades, whence a staircase of considerable dimensions leads to the sala or principal room of the palace. The general character is that of grandeur, but devoid altogether of the severity which so strongly marks the Florentine school. The noblest example of a palace in the world is that of the Farnese family at Rome.

"The palaces of Rome are among the finest architectural works in Europe; and of those in Rome, as we have before observed, none equals the Farnese, whose façade is given in Fig. 3 169. "Ce vaste palais Farnese, qui à tout prendre, pour la grandeur de la masse, la regularité de son ensemble, et l'excellence de son architecture, a tenu jusqu'ici, dans l'opinion des artistes, le premier rang entre tous les palais qu'on renomme," is the general description of it by De Quincy, upon whom we have drawn largely, and must continue to do so. This edifice, by San Gallo, forms a quadrangle of 256 feet by 185 feet. It is constructed of brick, with the exception of the dressings of the doors and windows, the quoins of the fronts, and the entablature and loggia in the Strada Giulia, which are of travertine stone. Of the same stone, beautifully wrought, is the interior of the court. The building consists of three stories, including that on the ground, which, in the elevations or façades, are separated by impost cornices. The only break in its symmetry and simplicity occurs in the loggia, placed in the centre of the first story, which connects the windows on each side of it by four columns. On the ground story the windows are decorated with square-headed dressings of extremely simple design; in the next story they are flanked by columns, whose entablatures are crowned alternately with triangular and circular pediments; and in the third story are circular-headed windows, crowned throughout with triangular pediments. The taste in which these last is composed, is not so good as the rest, though they were probably the work of Michael Angelo, of whose cornice to the edifice Vasari observes.—"E stupendissimo il cornicione maggiore del medesimo palazzo nella facciata dinanzi, non si potendo alcuna cosa ne più bella ne più magnifica desiderare." The façade towards the Strada Giulia is different from the other fronts in the centre only, wherein there are three stories of arcades to the loggia, each of whose piers are decorated with columns of the Doric, Ionic, and Corinthian orders in the respective stories as they rise, and these in form and dimensions correspond with the three ranks of arcades towards the court. It appears probable that this central arrangement was not in the original design of San Gallo, but introduced when the third story was completed. Magnificent as, from its simplicity and symmetry, is the exterior of this palace, which, as De Quincy observes—"est un édifice toujours digne d'être le sejour d'un prince," yet does it not exceed the beauty of the interior. The quadrangle of the court is 88 feet square between the columns of the arcades, and is composed with three stories, in which the central arrangement above mentioned towards the Villa Giulia is repeated on the two lower stories, over the upper whereof is a solid wall pierced in the windows. The piers of the lower arcade are ornamented with Doric columns, whose entablature is charged with triglyphs in its frieze, and its metopæ are sculptured with various symbols. The impost of the piers are very finely profiled, so as to form the entablatures, when continued, over the columns of the entrance vestibule. In the Ionic arcade, over this, the frieze of the order is decorated with a series of festoons. The distribution of the different apartments and passage is well contrived. All about the building is on a scale of great grandeur. Though long unoccupied, and a large portion of its internal ornaments has disappeared, it still commands our admiration in the Carracci Gallery, which has continued to serve as a model for all subsequent works of the kind. The architecture of the Farnese palace, more especially as respects the arcades of its court, is the most perfect adaptation of ancient arrangement to more modern habits that has ever been designed. We here allude, more particularly, to the arcades, upon whose piers orders of columns are introduced. This species of composition, heavier, doubtless, less elegant, yet more solid than simple colonnades, is, on the last account, preferable to them, where several stories rise above one [illegible] theatres and amphitheatres; and in its application at the Farnese palace rivals in beauty all that antiquity makes us in its remains acquainted with. San Gallo, its architect, died in 1546."

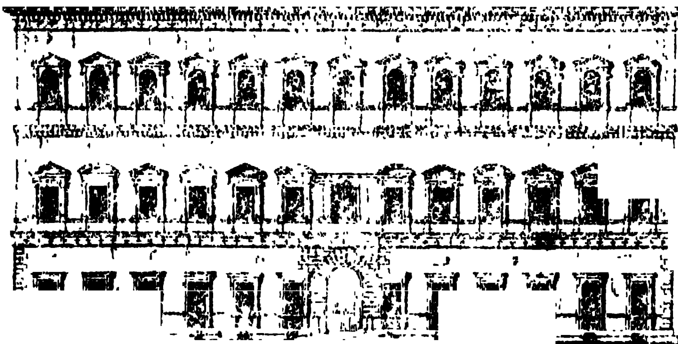


Fig. 1 FARNESE PALACE.

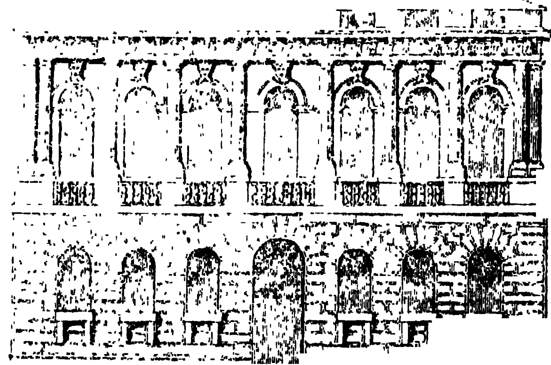


Fig. 2. POMPEI PALACE, VERONA.

The Venetian school is spoken of at much greater length than the others, and is, in our opinion, not a little over rated; for when we come to examine some of its most noted productions, we find them to be made up of insignificant parts, and petty orders treated in a formal, dry, and meagre manner, without any of that richness, or of that artist-like freedom, which would reconcile us to the orders being employed merely in half-columns and pilasters, as decorated to one or more stories of a building.

"*The Venetian School* is characterised by its lightness and elegance; by the convenient distribution it displays; and by the abundant, perhaps exuberant, use of columns, pilasters, and arcades, which enter into its composition. Like its sister school of painting, its address is more to the senses than is the case with those we have just quitted. We have already given an account of the church of St. Mark, in the 12th century; from which period, as the republic rose into importance by its arms and commerce, its arts were destined to an equally brilliant career. The possession in its provinces of some fine monuments of antiquity, as well as its early acquaintance with Greece, would, of course, work beneficially for the advancement of its architecture. That species of luxury, the natural result of a desire on the part of individuals to perpetuate their names through the medium of their habitations, though not productive of works on a grand or monumental scale, leads, in a democracy (as were the states of Venice), to a very general display of moderately splendid and elegant palaces. Hence the extraordinary number of specimens of the building art supplied by the Venetian school.

"San Micheli, who was born in 1484, may, with propriety, be called its founder. Having visited Rome at the early age of 16, for the purpose of studying its ancient monuments of art, and having in that city found much employment, he, after many years of absence, returned to his native country. The mode in which he combined pure and beautiful architecture with the requisites called for in fortifications may be seen displayed to great advantage at Verona, in which city the *Porta del Palio* is an instance of his wonderful ingenuity and taste. But his most admired works are his palaces at Verona; though, perhaps, that of the Grimani family at Venice is his most magnificent production. The general style of composition, very different from that of the palaces of Florence and Rome, is marked by the use of a basement of rustic work, wherefrom an order rises, often with arched windows, in which he greatly delighted, and these were connected with the order after the manner of an arcade, the whole being crowned with the proper entablature. As an example, we give in Fig. 3, the façade of the Pompei palace at Verona. The genius of San Micheli was of the very highest order; his works are as conspicuous for excellent construction as they are for convenience, unity, harmony, and simplicity, which threw into shade the minor abuses occasionally found in them. If he had no other testimony, it would be sufficient to say, that for his talents he was held to be in great esteem by Michael Angelo; and our advice to the student would be to study his works with diligence. San Micheli devoted himself with great ardour to the practice of military architecture; and though the invention was not for a long time afterwards assigned to him, he was the author of the system used by Vauban and his school, who, for a long period, deprived him of the credit of it. Before him all the ramparts of a fortification were round or square. He introduced a new method, inventing the triangular and pentangular bastion, with plain fossés, flanks and square bases, which doubled the support; he moreover not only flanked the curtain, but all the fossé to the next bastion, the covered way, and glacis. The mystery of this art consisted in defending every part of the inclosure by the flank of a bastion; hence, mak-

ing it round and square, the front of it, that is, the space which remains in the triangle, which was before undefended, was by San Micheli provided against.

In this example of San Micheli's style, the Palazzo Pompei at Verona, the basement is the best part of the composition, for the order is too small in proportion to the rest, and the openings on the principal floor as much too large, at least as windows, for the piers between them must be most inconveniently narrow within. It is rather singular, that while he was upon the subject of Italian architecture, Mr. Gwilt should not have alluded to the recent introduction of the *palazzo* style, in this country. As an example of it, he gives the façade of the Palazzo Pandolfini at Florence, strongly recommending that and the Palazzo Farnese, to the "elaborate study of the young architect," but without informing him, that by going into Pall Mall, he would perceive what use had been made both of the one and the other, by Mr. Barry, in the two adjoining club houses—the Travellers and the Reform. Though neither copies nor even imitations—in the ordinary meaning of the term, they are evidently borrowed from those prototypes, which in point of mere taste, are there improved upon and refined. The Reform Club House has been spoken of, by some, as being a direct copy of the Farnese; with what justice or judgment, may be seen from the above representation of the latter, which though too small to do more than afford an idea of the general composition, shows the manner in which the entrance and window on each side of it are squeezed together, produces anything but an agreeable effect; while the centre window above, exceptionable in character at the best, is, so introduced as to constitute a striking blemish in the whole design.

We must now take leave of Mr. Gwilt's work, which we should have been happy to have been able to speak of in less qualified terms of approbation. It contains a great deal of valuable, but not so much fresh matter as it might have done; but it also contains many opinions which we should be the last to support, and which are not likely to gain ground with the public, at the present day. We cannot, however, conclude, without expressing our high approbation of the spirited manner with which the publishers have got up the work, both in the typography and illustrations, the latter are beautifully executed as wood, or may be seen by the above specimens, which we have been permitted to select from the work.

Ensamples of Railway making; which, although not of English practice, are submitted, with Practical Illustrations to the Civil Engineer, and the British and Irish public. London: Architectural Library, 59, High Holborn.

The great disparity between the cost of railways in this country and that of similar works in America, is worthy at the present time of giving rise to some important considerations. Whilst on this side of the Atlantic, our main lines of railway have been constructed of materials extremely durable, in a manner remarkable for strength and solidity, and according to a standard of excellence with respect to gradients, which far surpasses any thing that has been attempted under like circumstances in other countries, the policy of absorbing such vast sums of money as have been required to effect all this is at least open to controversy. Hitherto every thing has been done in accordance with our national character, and never has that spirit of energy and industry which marks the Briton under every varying circumstance of time and distance, been more proudly exhibited than in the bold and ardent expedition with which the surface of his country was chequered by a net work of great commercial highways, constructed in almost every respect on principles the very antipodes of those which have guided other nations in their imitation of the same spirit. Seizing at once upon the experimental fact, that the friction of iron wheels upon iron roads is incomparably smaller than upon roads of stone, and connecting this with the no less certain truth, that resistance to motion is made up of friction and gravity, the English engineer conceived the grand idea of almost annihilating gravity by reducing the track of the railway to nearly a perfect level. It was demonstrable that the same absolute power which could impel a given weight on a common road at 10 miles an hour, would, on a level railway, impel five times that weight at treble the velocity, and it was further unquestionable that an inclination greater than 1 in 224 would at least double the power required to effect this, and thus diminish the superiority of the railway by one half. If a horizontal railway be compared with a horizontal common road, the superiority of the former over the latter is as 15 to 1; but if a railway inclining 1 in 30 be compared with a common road also inclining 1 in 30, its superiority in this case is only as $1\frac{1}{2}$ to 1. Following out the principle of which these are illustrations, it is no less obvious now than it was in the origin of railways, that the more nearly the planes of a railway approach to a level, the more superiority will they present over the common road. It was this principle which demanded in the name alike of science and of commerce, that in the track of the railway every mountain should be brought low, and every valley should be filled up; it was this which caused the transport of vast masses of earth from the higher to the lower parts of the country, which forced the deep excavation, reared the lofty embankment, bored the yawning tunnel, and dealt with all the most solid materials of earth, as if they had been the playthings of a baby's doll-house, instead of fabrics which require to be encountered by the sinews of hosts and the wealth of nations.

For, acting on principles which appeared to be sanctioned by every maxim of wisdom and experience, who can blame, with any show of reason, the engineers of this country, to whom the world is so much indebted, no less in the early origin, than during the steady progress of railway engineering. Fifteen years ago, when railway science was in its infancy, no voice was raised in opposition to the principle of almost horizontal gradients, and the necessity for those gigantic works which this principle demanded was as heartily acquiesced in by directors, by shareholders, and by the whole public, as by the engineers themselves. Nay, had it been otherwise—had the engineers stood alone in support of their principle—had the public voice been against them—and had the public press branded their projects as extravagant and wasteful, we are amongst the number of those who contend that they would still have done right to maintain their principle, and we should have applauded and admired them the more for carrying, in the first instance, a superior degree of excellence into those works which were destined to furnish an example to the whole civilized world. We confidently appeal to any competent judge, who, thoroughly understanding the mechanical and political distinctions between the railway and the common road, shall fairly and dispassionately review the circumstances of this country, whether we should have done well or wisely to adopt a less horizontal succession of planes for those main lines which are probably destined to endure for ages, as the great arteries through which commerce will ramify into a thousand interior channels all over the face of the country. While we thus regard with great satisfaction the superior character with respect to gradients which has been adopted for all the great railways of this country, there is yet another element in their construction, which, while it influences in no degree whatever the facilities for locomotion, yet contrasts remarkably in point of expense with corresponding works on the American lines. We shall readily be understood here as referring to those costly bridges and viaducts of iron, brick and stone, which have so enormously swelled the estimates for executing our principal railways. To decide upon the kind of gradients to be adopted for a given line of railway—a decision which regulates, more than any thing else, the cost of its construction—required, in the first instance, only a knowledge of simple principles, and in the absence of that experience which later years have supplied with respect to the comparative expense of working lines with steep and with level gradients, our engineers acted in a spirit of perfectly sound wisdom, when they laid the greatest practicable tax upon capital for the purpose of enabling the nation to realize, in its full extent, the superior advantages of railway transit. But in deciding on the style and character of the attendant works, which are entirely independent of the surface of the railway, the question assumes a purely commercial aspect, and may be thus stated: Suppose a line of railway with the most complete and substantial works of masonry, to have cost, say, one million of money, and suppose the same line could have been constructed with a more perishable class of works, as for instance, bridges and viaducts of timber, at an expense of half this sum, which kind of work is it most judicious to adopt, having regard to the circumstance, that after the lapse of a certain number of years the constructions of timber will require to be renewed, whilst those of masonry would require only very trifling repairs. Suppose in the former case, where the railway had cost a million sterling, the interest derived from the expended capital would amount to 5 per cent per annum. It is clear that in the latter case, where the line only cost half a million, the interest derivable on the capital would be 10 per cent. Now supposing 5 per cent of this to be set aside as a reserved fund, would the works of timber last so long a time as not to require restoration, until the reserved fund had sufficiently accumulated to effect this restoration? This is the grand point which should decide between the adoption of timber, or a more expensive and durable material for the architectural works of railways. We are, not here to be understood, for one moment, as contending that any such proportion, as that which has been assumed, exists between the cost of a railway with stone bridges and viaducts and one in which their works

are of wood. What we have said, however, will be sufficient to indicate the general principle of the comparison, and the utmost concession we are prepared at present to make to the champions of cheap and therefore temporary railways, is this, that the comparative cost and the comparative durability of the two classes of works are, in all cases, worthy of being considered by the engineer in connexion with the estimated amount of revenue derivable from any given line.

We are aware that, in all this, we are stating nothing new to the engineer; nothing but what has already occurred to most of the leading members in the profession, and nothing but what will be extensively practised, in laying out the numerous branch railways, which the convenience of the country still requires. Our object in making these observations will be amply fulfilled, if they succeed, in disabusing some part of the public mind, of the notion, that the costly stations and bridges and viaducts are all that distinguish our railways from those of Europe and of America. It should be remembered, that the much larger capital expended on our works has effected a system of levels, which enables us to command far higher speeds, and to realize, in every way, greater advantages from the railway, as compared with the common road. In every case where it is desired to take a comprehensive view of railways, as a political question, it is essential to distinguish between that part of the cost which is due to the superior character of the buildings connected with the railway, and that which is incurred in conformity with principles immediately connected with the facilities for working locomotive power. On the former of these points, we grant, that a statesman, a merchant, or a financier of any kind, may form a competent judgment, with proper data before him. On the latter, the only qualified judge is the engineer, because a decision must in most cases be made with reference to the future, and particularly with reference to the future auspices of engineering and mechanical skill. Thus, in the origin of railways, the engineer alone was qualified to chalk out a system of gradients which should correspond with the known properties of the locomotive engine, and of iron as a material for the wheels of carriages to roll upon—so in like manner Mr. Brunel, or those of like qualifications, are alone entitled to consideration in deciding such a question as that of the gauge to be adopted for the Great Western Railway, because the accuracy of the decision depended upon the truth or error of certain prognostications in physical science, which a mere financier, however able, is not competent to entertain. The engineer, in fact, must regulate his operations, both by past experience and by anticipations of the future; to what extent these latter are or should be based upon, the former depends on many circumstances, but to some important extent, all will admit, that the past should influence our future projects of every kind. It would, therefore, be highly desirable at the present time, that accurate and comprehensive returns should be framed of the actual working cost of locomotive power on all railways of every different rate of inclination, in order that a correct judgment may be formed upon the influence which gradients really exert in affecting the working expenses of railways. Thus would information of great value be placed at the engineer's command; but until sufficient data have been obtained to clear this subject of the obscurity which now rests upon it, we certainly must protest against the blind and wholesale jumbling which has been perpetrated by some who profess to be authorities on the subject of railway estimates. We insist, most strongly, upon the necessity for separating the cost of attendant works from those which have been rendered essential purely by the character of the gradients adopted; and we warn all those, who, without any engineering knowledge to guide them, shall be rash enough to commit themselves to paper, on subjects of this nature, that the less they have to do with the engineering part of the subject the better. The attendant works, as we have said, involve more or less of commercial considerations, and these should therefore be free for discussion; and anything possessing novelty and merit, which can be placed before the engineer in the way of designs, applicable to such attendant works, will no doubt be received by the profession at large with interest and gratification.

The spirited publisher of the work before us, is already too well known, and too highly valued by the profession to require anything from us in the way of general praise. If any such testimony were wanting, it will always be gratifying to acknowledge the many valuable contributions to engineering science, which Mr. Weale has originated, and which he has been something more than a secondary means of giving to the world. In the production entitled Railway Ensamples, however, Mr. Weale appears before us in a new character. He has here assumed the province of authorship, and in this capacity places himself before the bar of public opinion, subject to that judgment, whether of condemnation or approval, which that severe tribunal hesitates not to pronounce, on all who thus prominently court her notice. In some respects, we feel bound to congratulate Mr. Weale upon the character he has here assumed—we hail with pleasure, on a first view, the modest and simple announcement of the titlepage, and assuming the value of his examples, as specimens of design, we are glad to perceive that an individual has had the spirit and sagacity to present to the notice of the English engineer a connected series of works from a foreign railway. On looking further into their examples, we find them to be drawn from the Utica and Syracuse Railway, an American line about 53 miles in length. Whether these examples be worthy or not of presentation, in such a form, to the engineers of this country, is not now the question; supposing they are so, the profession is undoubtedly much indebted to the individual who has thus incurred the pains and expense of bringing them before their notice. Mr. Weale's appearance in the character of an author, however, is not limited to the dry and brief notices which are required to illustrate a set of railway plates, but embraces a somewhat extensive catalogue of subjects connected with railway engineering which have been condensed into 40 pages of preliminary observations. These observations are accompanied by several maps, and by plates of an American locomotive engine, and an American earth excavator. Although we cannot agree with the writer in many of these preliminary observations, we have at the same time great pleasure in stating, that the reader will find amongst them much that is interesting and amusing. We may mention particularly the description of the American locomotives, and that of the Satellite engine on the London and Brighton Railway. We are not able to say much in praise of the excavating machine; it appears to be a very clumsy affair, encumbered by a mass of machinery out of all proportion to the effect required. Its economy is extremely doubtful except when put in competition with very high prices for labour, in which case it might possibly be more economical than manual labour for excavating earth. The machine is said to be capable of excavating 1500 cubic yards in 12 hours, at a cost for fuel of 12s. per diem. To this statement, Mr. Weale adds, that "earthwork in England has generally been taken at 10d. to 1s. per yard." He forgets, however, that this price includes the carriage or haulage of the earth, and that the price of getting and filling the stuff, which is all that the American machine performs, is commonly not more than from 2d. to 5d. per yard. It is, therefore, some mean between these two prices which should be taken for comparison with the machine; but at present, we are not able to make this comparison, having no information as to her cost and working expenses.

A second division of the preliminary observations is principally directed to a comparison between the cost of the American railways and those of this country. The principal facts on which Mr. Weale argues, are these, that the aggregate cost of the American railways was estimated in 1839, at £1000 per mile, including all buildings and apparatus; and secondly, that actual works are not executed cheaper in America than in this country, as the greater expense of timber here is counterbalanced by the greater expense of labour there. He therefore, concludes that the greatly increased cost of the English railways has been caused by the more expensive nature of the works, that is by the difference of the two systems of construction. This is undoubtedly true to a certain extent, and here the comparison might cease, with this observation, that we have obtained far superior railways, by expending more money in their construction than the Americans. In case, however, any erroneous notions may be formed as to the comparative eligibility of the two systems, which are here contrasted, it may be sufficient to suggest, that no *fair* comparison can be made without full particulars, not only of the works executed on each, but also of the gradients and curves with which the lines were respectively constructed. It will be found that gradients of 25 to 30 ft. per mile are considered highly favourable in America, whereas, those of greater steepness than 15 or 16 feet per mile, have been held in this country to be highly objectionable. Again, as to curves, the American lines abound with sharp bends, which are quite inadmissible in those of Great Britain. A large proportion of the American lines are graded only for single lines of way; and in many of those which are graded for double lines, only a single track has been laid down. The cost per mile, as stated above, furnishes a very unfair comparison, in every respect, with the English lines, where the gradients and curves are entirely of a different order, the works are far more substantial, are mostly constructed for a double line of way, and where the cost of land has necessarily been excessive; whereas, in America the land in many cases has cost almost nothing. Another important point of comparison is the annual expense of working the railways in the two countries. M. De Gerstner estimated, in 1839, that the annual expense of working the American lines was 63·61 per cent. of the gross income, and that the interest on the whole capital invested in railroads in the United States does not exceed 5½ per cent. per annum. Now this annual expense is far greater than that of working the English

railways—as, for instance, the Grand Junction costs 55·53 of the income, the Great Western 51·87 per cent.; and taking the average of all the railways, it would be found considerably below the American lines. In the case of the English lines, this amount will be still further reduced when their heavy earth works become perfectly settled, and no longer subject to those slips which, up to this time, have occasioned such heavy expenses. We find that the average dividend of 32 railways reported in the *Railway Times* amounts to 4*l.* 10*s.* per cent. per annum, which, although less in absolute amount than that produced by the American lines, is in reality far greater when the prospective circumstances are considered. Thus, for instance, supposing the slight timber bridges and viaducts of the American lines will last 20 years, which is a favourable supposition, where is the capital to come from in order to effect their restoration at the end of that time. Undoubtedly it can scarcely be reserved out of the present dividends of 5½ per cent., for nearly the whole amount will be required to provide the large capital for restoring their perishable works. On the other hand, the English lines, firmly and substantially constructed, are paying a steady dividend of 4½ per cent. on the average and no reserved fund is required, as the works are calculated to endure for many centuries. The conclusion to be drawn from all this is highly unfavourable to the American system, and at the same time encouraging to those who have embarked their capital in our own lines. While the railways of the United States must inevitably, in a very few years, present a condition of premature decay, with a hopeless prospect of restitution, those of this country will, in all probability, afford a more favourable investment for capital than at the present day. We have no wish to dispute much that is really valuable and ingenious in the railways of the United States, but we must contend against these lines being held up as a model for the great trunk lines of this country. Mr. Weale points out several lines in which he considers the American system would be applicable, and particularly advocates its adoption in Ireland. With certain restrictions, and under certain circumstances connected with the expected revenue, and the capital available to the undertakings, the American system of cheap *temporary* constructions and inferior gradients may be advisable for some lines in Ireland, but we should extremely regret to see the main lines in that country laid out on such a principle.

The most valuable part of Mr. Weale's book, because the most practical, and that which contains the most information is that which relates to the bridges actually constructed for the American railways.

The Utica and Syracuse Railroad, which has been selected as affording so favourable a specimen of cheap engineering in the United States, forms part of the great line of communication across the states of Massachusets and New York. This great line, which has been executed by several different companies, is upwards of 530 miles in length. It commences at Boston, in Massachusets, and passing through or near the towns of Worcester, West Stockbridge, Albany, Schenectady, Utica, Rome, Syracuse, Auburn, Waterloo, and Worcester, sweeps along the southern shore of Lake Ontario, for the last 200 miles of its course, from the Atlantic Ocean, and terminates at Buffalo, the north-eastern extremity of Lake Erie. The part of this great line which lies between Utica and Syracuse, is 53 miles in length, and throughout its course it follows the line of the Erie Canal. We have no information as to the gradients on this line, but judge that that they must be extremely favourable, as the Erie Canal was on a perfectly dead level, without any canal lock whatever between Utica and Syracuse, and for several miles east of the former place.

After an attentive examination of the plates referring to these bridges, we feel bound to pronounce that, as specimens of carpentry, they possess by no means superior merit. In place of that admirable system of timbers abutting against each other, which gives so much stiffness to some of the best specimens of English carpentry, the light planks of the American bridges are held together by an innumerable quantity of bolts, and the proper strength of the timber is not applied to the fullest advantage. The white pine, which is used so extensively in the American bridges is a timber very little known in this country. It is a white wood with a short grain, possessing little strength of fibre, and abounding in small black knots; it is used a good deal in Edinburgh and other parts of Scotland for the interior of houses, but is never applied to external work.

In addition to the plates of the bridges, and of the viaduct over a considerable valley and creek on this railway, there are several plates, showing the system of piling and laying the permanent way on a part of the line about 19 miles in length which was laid upon piles, the remaining length being graded, as it is called in America, that is formed by cuttings and embankments, as usual in this country.

There are also several plates showing culverts, but these possess little interest for the English reader; nor could the engineer derive any advantage from a comparison of this part of the American railway system with his own. The last portion of the work contains an interesting account (historical and statistical) of the Belgian railways by Mr. Edward Dobson, but we believe this part of the work is only a translation.

These ensamples of railway making, affording the best account which has yet been published in this country of the railroad works of the United States, will certainly find a place in the library of every engineer. Although we cannot consent to the wholesale adoption of the American system which Mr. Weale appears to advocate, there are yet many cases, both here and on the continent, in which these examples will prove very useful in railway engineering. We must not omit to mention, in conclusion, that the plates, as in all Mr. Weale's works, are admirably executed, and the details are so well shown that the most ordinary capacity may readily comprehend every part of the construction.

The Principles and Practice of Land, Engineering, Trigonometrical Subterraneous, and Marine Surveying. By Charles Bourns, C. E. London: John Ollivier.

We need scarcely say that on all occasions we feel much greater pleasure in speaking well of any book which comes under our notice than when we are obliged to pronounce an opinion of almost unqualified censure. In the present instance, however, an impartial reviewer has only the latter alternative; and we could wish sincerely for the credit of the profession both at home and abroad, that the production of works with such feeble claims upon public favour were much less rare than it is. We are told in the preface of Mr. Bourns' book, that the aim with which it is written has been "the formation of a book of reference." Had this really been the case, had the volume been merely a work of reference, and had it been so styled on its title-page, we should have known what to expect, and should never have been deceived into supposing that we were opening a book containing the principles and practice of every kind of surveying. But we are told in a few lines further on in the preface, "that the volume is intended to constitute a consistent whole; so that to understand an advanced part, a person must be conversant with what goes before." How then can it be a work of reference in the common acceptation of this term, since by the author's own showing, it requires a regular study to be made of what goes before, in order to understand any advanced part. Surely this destroys its value as a work of reference. Indiscriminate censure is seldom just, and in the present case we are far from saying that the book before us is absolutely worthless, and that there is nothing in it which might be instructive to the professional man. At the same time we feel bound to enter a strong protest against that too prevalent system of book-making of which this work is a remarkable specimen. It contains an immense mass of antiquated information injudiciously selected and badly arranged. The few grains of original matter which are scattered through its pages relate to minute points of professional practice, often magnified into undue importance, and introduced to the exclusion of more valuable things for no reason that we can discover, except that they happen to have formed part of the author's own practice, or to have been introduced by some of his friends. We make no pretence of having waded through the whole contents of this book, which is an octavo volume of 356 pages; but having looked into several of those parts of it which are not purely elementary, the general impression is by no means such as to encourage a further search. In every point of view the work is far inferior to those of Mr. Bruff, and to Mr. Williams' Geodesy, books which have been reviewed in former numbers of the *Journal*.

Blunt's Civil Engineer and Practical Mechanist. Division C. Portion the Second. London: Ackerman and Co.

This portion is principally devoted to the delineation and description of machinery by the Messrs. Rennie. The first plate is of the gun-boring and turning mill, with the lathe apparatus—machinery used in gun and engine manufacture. Another plate is of Messrs. Rennie's great boring lathe; it is used in the boring of cylinders, condensers, air pumps, and bored vessels of engines and mills, and in turning pistons, rods, shafts and journals. Three plates are of their marine dredging and excavating machine, part of which was in the first portion. The last plate is devoted to Sir Isambard Brunel's shield for the Thames Tunnel. We must observe, however that although we have used the term plate to express the several sheets, many parts of the works are separately described on each sheet, and form valuable drawings for reference.

Turning and Mechanical Manipulation, intended as a Work of General Reference and Practical Instruction, on the Lathe and the various Mechanical Pursuits followed by Amateurs. By CHARLES HOLTZAPFFEL, A. Inst. C. E.

MR. HOLTZAPFFEL looking at the dearth of works on the arts professed by the mechanical engineer, has felt himself called upon to bring before the public the results of his experience on a subject of so much interest and value. It is fortunate, perhaps, for the mechanical engineer, that turning and many other of his pursuits have for a long period formed a favourite occupation with many wealthy individuals, as thereby an amount of patronage has been conferred on the tool maker, such as could have been obtained by no other means, and which has powerfully conduced to the improvement of the tools used in this important department, while many experiments have been made at private expense, which could scarcely have been executed by persons engaged in business. With a class of wealthy amateurs to whom to look for supporters, Mr. Holtzapffel could scarcely have rendered a more acceptable service than the production of a work, which, both to the practical man and the amateur, must be of high utility. Mr. Holtzapffel, in the resources of his large establishment, and availing himself of the experience of his predecessors in the firm, possesses many advantages for the task he has undertaken, and seems to devote himself to it *con amore*. The treatment of it he proposes to enter into at some length, and we can scarcely blame him for this, as the public will profit by the extent of labour devoted to the subject.

The volume now before us is one of five, and is devoted to the consideration of the various materials used. The second will discuss the principles of construction and application of cutting tools; the third will treat of hand turning; the fourth of complex or ornamental turning, and the fifth of the principles and practice of amateur mechanical engineering.

The description of the materials is distributed into three classes; the vegetable, the animal, and the mineral kingdoms. The description of the various kinds of woods, not only developes new facts as to their technical peculiarities, but illustrates their botanical characteristics, a portion of the work to which Professor Royle has contributed his valuable assistance. The materials from the animal kingdom, which are treated with no less ability, include shells and mother of pearl, bones, horn, tortoiseshell, whalebone and ivory. The materials from the mineral kingdom, embrace clay, amber, jet, cannel coal, the ornamental and precious stones, the metals and their alloys. To state, however, that the work is limited to a simple description of these materials, would convey an inadequate idea of its value, as it abounds with practical descriptions of many important or interesting processes. Thus we have observations on seasoning, softening, bending, and colouring wood; the manufacture of iron; forging, hardening and tempering of iron and steel; the melting and mixing of metals; and the properties of alloys; casting and founding; wire drawing and soldering. To the description of tempering alone twenty-five pages are devoted, and the subject is treated with a minuteness and ability, which leave nothing to be desired.

The Atmospheric Railway. Observations on the Report of Sir F. Smith and Professor Barlow. By THOMAS F. BERGIN, M.R.I.A. Dublin: Hodges and Smith, 1843.

Considerable controversy has existed on this subject, and a long correspondence has taken place between Mr. Bergin and Professor Barlow: with respect to it, we, however, are more inclined to look forward to the result of the great trial now in progress at Dublin, than to depend upon any mathematical formula, upon the bases of which no party seems to be agreed. The experiment will soon be satisfactorily settled one way or other, and the merits or demerits of the atmospheric system, will be shown in all their extent. Mr. Bergin has devoted considerable ability to the discussion of the subject, and the many who saw reason to distrust Professor Barlow's deductions, cannot do better than consult this pamphlet.

A Series of Diagrams, Illustrative of the Principles of Mechanical Philosophy. Drawn on Stone, by HENRY CHAPMAN, and Printed in Colours, by C. F. Cheffins. London: Chapman and Hall.

The fourth and fifth parts illustrate the pulley, inclined plane and wedge. The plan, which is that of giving practical and useful applications of the simple powers is well carried out, and thus both theory and practice are at once brought to bear on the instruction of the student; while it is not only a good work for the machinist, but an excellent drawing book. The work contains so many illustration valuable machines, that we feel ourselves still more strongly called upon to urge the necessity of some letter-press explanations accompanying the plates, treating on the theory of the powers and their several applications.

The Literary and Scientific Pocket Book. By J. W. GUTCH. London: Lumley.

This contains much valuable matter of reference, and as such, we have much pleasure in recommending it to our readers.

ON THE STRENGTH OF BEAMS.

SIR—The problem proposed for solution by your correspondent "Concrete," at page 27 of the last month's *Journal*, is certainly one of great interest and importance; as he states, I believe, it has not been investigated in any of the standard works on the strength of materials. Like all questions connected with the strains of beams, it is one which, whether considered theoretically or practically, is of the most complicated nature and of great difficulty; particularly if investigated with mathematical accuracy. There are so many data to such questions, varying in each particular instance—so many circumstances which modify the general result—such as the deflection of the beam, and consequent variation of the length of leverage, the position of the neutral line, &c., that since the time of Galileo to the present day, they have always been considered as questions of the greatest difficulty; and yet there is no subject connected with theoretical mechanics more interesting to the engineer; none more useful, especially in the present age, when timber and iron are so extensively used in the most stupendous structures, the economy and durability of which depend so much upon the proper application of mechanical principles. I am sorry to say, however, that even now, there are many engineers, particularly those belonging to the old school, and such as have not the least knowledge of the elementary principles of mechanics, who will not admit its utility; who, because such men as Telford, Brindley, George Stephenson, and many others, have risen to eminence by the mere force of their talents, unfettered by, what they term college knowledge, think that they may also jog on on the "thumb of rule" system. And yet, how frequently have I seen these pseudo-engineers, these practical men, who will not look into a book, for fear it should destroy the originality of their conceptions, fall into the greatest errors from the want of such knowledge. I shall merely state one instance. A resident engineer of one of our railways proposed a plan for strengthening a timber bridge on the line, and in order to test the efficiency of his improvement, made a model of the bridge on the scale, if I recollect rightly, of one inch to the foot; he found that the model would support a certain weight, and thence argued in a truly practical manner, that as the bridge was twelve times the model, it would support twelve times the weight! Thus satisfactorily establishing the utility of his proposed improvement. To return to the question to be solved. If we omit the consideration of the deflection of the beam, the result will be simple and sufficiently correct for practical purposes, and the problem in question may easily be reduced to that of finding the dimension and form of a beam resting loosely on two supports, necessary to sustain a given weight, (in this instance 42 tons,) placed at the centre of the beam.

Your correspondent states that he found upon experiment, that a bar iron loaded, as he describes, broke near the two supports; this certainly is strange, and contrary to what we should expect theoretically and practically; for it is evident that the beam between the two supports is more curved at the centre than near the supports, and consequently the strain, being measured by the tension of the fibres, must be greatest in the centre, and gradually diminish to the point of support. I have several times repeated his experiment on a small scale, using, however, wood instead of iron, and have always found that the wood broke in the centre between the supports; of course with the same proportion of external and internal parts mentioned by your correspondent.

It is also clear, from the principle of the lever, that the strain at the centre of the beam, is the same as that produced by a weight of 12 tons placed there, except that the action is reversed: the upper side of the beam will now be compressed in place of being extended, and the under side extended instead of being compressed. If what I have advanced be correct, as I believe, it will result that the best form to give to the beam is the parabolic; that is, the depth of the beam should be greatest at the middle point and diminish at the ordinates of a parabola towards the supports. As the reasons for assuming this form to be the best, are given in all works on the strength of materials, it would be useless to repeat them here. It is generally considered best to have the curved side of the beam upwards in such a case, but as in this example the action is reversed, it follows that it would be advisable to have the curved side downwards. As your correspondent only states the proportion of the distances of the weights from the points of supports to that between them, it is impossible to give the exact dimensions. I have not thought it necessary to give a diagram, as I believe, this explanation may be easily understood from the description, and by referring to that given by your correspondent.

If no better attempt to solve this problem be offered, you will oblige me by inserting this letter.

I remain Sir,
Your obedient servant,
London, Jan. 10th, 1843. T. F.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

Dec. 19.—J. Shaw, Esq., in the Chair.

Mr. Fowler, Hon. Sec., on presenting a plan for rebuilding that portion of Hamburgh, lately destroyed by fire, from M. Chateauneuf, mentioned as a gratifying circumstance, that our countryman, Mr. Lindley, the engineer, had been appointed by the senate to superintend, in part, the rebuilding of the city.

Mr. Godwin read a paper on Tournay Cathedral, which was partly given in last month's *Journal*, and the continuation in the present number.

Jan. 9.—Charles Barry, Esq., V. P., in the Chair.

A paper was read "*On a new mode of constructing the Flues of Chimneys*," by Mr. Moon, surveyor, explaining an improvement in the construction of flues, of a circular form, of different sizes, from 8 to 14 inches in diameter; the bricks are arranged in courses, carried up and headed in the thickness of the wall.

"*Description of the Testimonial to the late Sir Harry Burrard Neale*," erected at Lymington, communicated by Mr. Draper, of Chichester, the architect. It consists of an obelisk, 76 feet high, constructed of Dartmoor granite, standing on a pedestal 18 feet high, the total cost is about £1,400.

Mr. Sylvester's process was described "*for rendering stone, brick, and other absorbent materials impervious to water.*" It consists of two solutions, the first a solution of soap, the second of alum; the brick or stone is first dipped in the solution of soap, and afterwards in the alum, or the solution may be applied with a brush. By the combination of the two solutions, a chemical action takes place, which fills the pores and resists the action of water and moisture. Colouring matter may be introduced into the solutions, and give them any tint that may be desired.

Mr. Billings introduced his "*Illustrations of a mode of striking Gothic tracery*;" they were principally selected from the old choir of Carlisle Cathedral, which was repaired in 1764. The principle upon which most of the varieties of the tracery in this cathedral were formed, was by the combination of curves all having their centres in the same series of lines, formed by dividing a square into four parts each way. The interstices were afterwards filled up by quatrefoil and trefoil ornament, but the main curves are all formed on the above principle. Mr. Billings introduced a fine specimen of tracery, described by circles struck from every intersection of the lines within the square as centres.

Jan. 23.—T. L. Donaldson, Esq., in the Chair.

A letter was read from Herr F. Eisenlohr, Professor, acknowledging the honour of being elected an honorary and corresponding member of the Institute; this letter contains some excellent remarks which we have been permitted to extract.

"I shall esteem it," says Herr Eisenlohr, "a great honour to be united in closer intimacy with your Institute, by the communication of anything relating to the profession. Such an intercourse and reciprocity among the architects of different countries is much to be wished for at the present time, which is principally distinguished from all previous epochs in the history of architecture by its want of unity. Attempts have been made for some time past to remedy this by imitations of the ancient Greek and Roman styles of architecture; and up to the present day many architects are repeating with various talent and success, the attempt to introduce those styles into the present edifices—some, even the imperfect conception of them, called by the French *la Renaissance*. On the other hand, in many places in Germany, a different course has been adopted, which, being partly suggested by the revival of a more christian spirit, partly by the patriotic feeling excited by the French revolution, leaned more to the christian architecture of the middle ages at home. This two principal divisions, each with their varities, stand opposed to one another here in Germany, and carry on, as it were, a contest in secret. The present age is engaged in seeking a something which at present does not exist, viz., unity in a sort of universal architecture. It seems to me, that no immediate and direct imitation in any style of architecture already existing, complete in itself, will lead to the desired result as long as the present age demands its rights, and the existing state of society requires something arising more from its own nature. When I consider also that hitherto in our art we have acted in a manner too little abstractive and scientific, and have *imitated* too much, still, on the other hand, it is not to be denied that we cannot and ought not to disregard history and its effects, that we must have some point in history at which to begin a root, from which a new stem may shoot up into blossom as from the soil of the present. It is quite clear that here also theory and history must go hand in hand, whereby we must with *consciousness* attain to that new and unprejudiced position which, in childlike innocence, unconsciously existed at the commencement of all previous epochs in art. The difference between our age and its problem, as regards architecture, and indeed every branch of the arts, consists in this that we ought to strive, so to say, with manly innocence, with manly knowledge and power, to attain to that point at which former periods in art have in their infancy begun of their own accord. Where there is nothing but an empty and groundless adherence to forms, where architectural fallacy and pretension, or a certain coquetterie is manifested, there an art of a peculiarly creative nature can never be looked for. It is true that many grand buildings have recently been erected in the Roman, Grecian, and so called Byzantine and Gothic styles, as, for instance, particularly at Munich. But they all want the enlivening principle of belonging to the present, and are only silent records of bygone styles of architecture. In the same way that we collect pictures of different schools in galleries, so King Louis has collected buildings of all possible periods; and as he had not got them at Munich, neither could he transport them thence from other parts; he had them built, and thus made a grand collection of buildings at Munich, but which is still deficient in historical authority. If, therefore, we would draw a comparison, we must say that the modern collection of buildings at Munich is, as far as regards the arts, worth about as much as a picture gallery containing a number of more or less successful copies from different masters and schools. If it be true that the spirit of the times is truly expressed in its buildings, that the architecture of every period is, as it were, a fossilized history, future generations will say that the present period was utterly devoid of character. By means of a more intimate acquaintance with the history of architecture, we have been provided with a vast quantity of subject matter, which has hitherto quite overwhelmed us, from its variety and quantity, so that we were quite robbed of our senses. Of this we must first get the mastery, and impelled by a careful observance, as well as by an artistical and inventive spirit regain our consciousness, without at the same time suffering the experience of history to remain useless. We must, on the one hand, investigate from a theoretical and scientific position, how far our architecture and its elements answer to the conditions of its purpose, of the building materials, climates, and so forth; and must, on the other hand, in looking back upon history, endeavour to find some point which presents constructions and forms similar to those which result from our abstract investigations, and thus a fruitful germ may be found for a modern and, in itself, harmonious style of architecture—a style which would gradually come into general use, and supersede all the lifeless imitations and mere whimsical charges of fashion. In this, it appears to me, consists the great architectural problem of the present age, which can only be solved by united efforts."

Report *on the Marbles from Lycia.*

A report was read from the committee appointed by the Institute to examine the articles that were recently discovered by Mr. Charles Fellowes amongst the ruins of Xanthus, an ancient city in Lycia, in Asia Minor, and lately deposited in the British Museum. Mr. Fellowes explained to the committee "that the tomb is situated on the side, on the slope of a hill, in the old town of Xanthus, consisted of a square shaft in one block, weighing about 80 tons, and 17 feet high. This shaft, which rested on a base or plinth rising six feet from the ground on one side, and the other rising but little above the present level of the earth, was surmounted by the bas-relief in question, the opposite sides of the relief being respectively 8 feet 4½ inches, and 7 feet 6 inches long making a total length of 31 feet 9 inches. It consisted of four angular and four central blocks of marble, each 9 inches thick and 3 feet 5 inches high. A kind of chamber was soon formed in the top of the monument about 7 feet 6 inches high, and 7 feet by 6. This was covered by a single block of marble forming the cornice, and hollowed out in the inside soffit so as to present the appearance of a beam and caissons. Mr. Fellowes considers the subject of the sculptures to represent the legend of the daughters of King Pandarus carried away by the harpies. There are also five figures, male and female, seated on chairs, which are evidently intended to be represented as made of bronze; on these chairs are very perceptible traces of a brownish tint approaching to red, showing that the ornament was indicated by colour, even without the outline being carved.

The figures are about an inch and a half in relief, and in many parts there are patches of blue colour on the ground, particularly on the undercutting of the hair, and especially where the recesses are protected by the overhanging tenia of the frieze, forming the top of the blocks. A portion of this blue colour had been taken off by Mr. Hawkins, and submitted to a chemical analysis by Dr. Faraday, who reported that "The substance is a mixture of wax with a pulverized blue smalt, coloured by cobalt, the smalt being in rather coarse patches; when the wax is charred away, each piece is seen by a moderate magnifier as a small fragment of glass."

On referring to the analysis of Egyptian blue colour by Dr. Ure, given in the 3rd vol., pp. 301—3 of Sir T. Gardiner Wilkinson's work on the manners and customs of the ancient Egyptians, there appears to be a great analogy in the composition of this blue and that described by Sir J. Wilkinson; as in the Egyptian specimen the blue pigment scraped from the stone is a pulverulent blue glass.

On the edge of the crest of a helmet were also collected some remains of a bright crimson red which have not yet been analyzed.

On the whole, the committee are of opinion that the appearances which they witnessed are sufficient to warrant their conclusion, that the ground throughout was painted blue, so as to give relief to the figures. Some other parts also had colour, but to what extent the rough state of the surface of the marbles did not enable the committee to ascertain.

The character of the sculpture of the figures denotes a very remote period of art, and it is, to a certain degree, rude, but the forms and embellishments of the bronze chairs are extremely refined, and betoken a class of art not unlike that of the triple temple in the Acropolis of Athens.

When the other marbles and fragments brought from Xanthus have been removed into the upper halls of the Museum, the committee will proceed with their examination on this interesting subject, and they will, if necessary, report to the Institute the result of their inquiries.

The Chairman, in consequence of the unavoidable absence of Mr. Britton, who was to have read a paper this evening, was requested by the secretaries to supply a paper, which he readily acceded to with his usual promptness in all similar difficulties, the subject of the paper was "*On the ruins of the city of Ani, in Armenia*," but as we are likely to give the paper in full next month, we defer giving any abstract.

The meetings for February will take place on Monday 6th, and 20th, at 8 o'clock.

INSTITUTION OF CIVIL ENGINEERS.

Jan. 10.—James Walker, Esq., President, in the chair.

This was the first meeting of the session, and was occupied by a discussion on a paper by Mr. Davison, describing the sinking of the deep well at Messrs. Truman and Co.'s, brewery, which was read at the close of last session. See *Journal*, Vol. 5, 1842, page 420.

Jan. 17.—The President in the Chair.

This was the annual general meeting of the Society, and was occupied in reading the report of the council, the election of the council and the distribution of the prizes; we must defer until next month a report of the proceedings when we hope to be able to give them in full.

DESTRUCTION OF THE ROUND-DOWN-CLIFF BY GUNPOWDER.

[We are partly indebted for the accompanying report to the *Times*, and through the kindness of two professional friends, who were on the spot and witnessed the explosion, we have been enabled to give considerable additional information; and have also added a rough sketch of the cliff, that was hastily taken, just before and after the explosion took place.]

Dover, Jan. 26th, 1843.

You will not be surprised to hear that the announcement that an explosion of 18,000 lb. of powder was to be made in the Round Down Cliff this afternoon brought an influx of strangers into this town; still, though considerable, it was not so large as I had expected. Curiosity was, I think, paralyzed by a vague fear of danger, which kept some thousands at home who might have witnessed it, as the event turned out, without the slightest shock to their nervous system. The experiment succeeded to admiration, and, as a specimen of engineering skill, confers the highest credit on Mr. Cubitt, who planned, and on his colleagues who assisted, in carrying it into execution.

Everybody has heard of the Shakspeare Cliff, and I have no doubt that a majority of your readers have seen it. I should feel it a superfluous task to speak of its vast height were not the next cliff to it, on the west, somewhat higher. That cliff is Round Down Cliff, the scene and subject of this day's operations. It rises to the height of 375 feet above high-water mark, and was, till this afternoon, of a singularly bold and picturesque character. To understand the reasons why it was resolved to remove yesterday no inconsiderable portion of it from the rugged base on which it has defied the winds and waves of centuries, I must make your readers acquainted with the intended line of railway between Folkestone and this place.

At Folkestone there will be a viaduct of great height and length. Then there will be a tunnel, called from a martello tower near it the Tower Tunnel, one third of a mile in length. Then comes a cutting through the chalk of two miles in length, called Warren's Cutting. Then comes the Abbott's Cliff tunnel, one mile and a quarter in length, and now half finished, although only commenced on the 16th of August last. From the Abbott's Cliff tunnel to the Shakespeare Cliff tunnel the railroad will be under the cliffs close to the sea, and protected from it by a strong wall of concrete two miles long, and with a parapet of such a height as will not preclude passengers from the splendid marine view which lies under them. Now it was found that when a straight line was drawn from the eastern mouth of the Abbott's Cliff tunnel to the western mouth of the Shakespeare tunnel, there was a projection on the Round Down Cliff which must be removed in some way or other to insure a direct passage. That projection, seen from the sea, had the appearance of a convex arc of a circle of considerable diameter. It is now removed, and some idea of its size may be formed from the fact that a square yard of chalk weighs two tons, and that it was intended by this day's experiment to remove 1,000,000 tons. The Shakspeare tunnel is three-quarters of a mile long, and it is about the same distance from that tunnel to the town of Dover.

Having premised thus much as to the locality of Round Down Cliff, I now proceed to describe, as briefly as I can, the means employed to detach from it such an immense mass of solid matter. A horizontal gallery F, Fig. 3, extended for about 100 yards parallel with the intended line of railway, from which cross galleries were driven from the centre and extremes. At the end of these cross galleries shafts were sunk, and at the bottom of each shaft was formed a chamber, 11 feet long, 5 feet high, and 4 feet 6 inches wide. In the eastern chamber were deposited 5000 lb. of gunpowder, in the western chamber 6000 lb., and in the centre chamber 7000 lb., making in the whole 18,000 lb. The gunpowder was in bags, placed in boxes. Loose powder was sprinkled over the bags, of which the mouths were opened, and the bursting charges were in the centre of the main charges. The distance of the charges from the face of the cliff was 70 feet at the centre and about 55 feet at each end. It was calculated that the powder, before it could find a vent, *must* move 100,000 yards of chalk, or 200,000 tons. It was also confidently expected that it *would* move 1,000,000 tons.

The following preparations were made to ignite this enormous quantity of powder;—At the back of the cliff a wooden shed was constructed, in which three electric batteries were erected. Each battery consisted of 18 Daniels' cylinders, and two common batteries of 20 plates each, to which were attached wires which communicated at the end of the charge by means of a very fine wire of platina, which the electric fluid as it passed over it, made red-hot, to fire the powder. The wires covered with yarn were spread upon the grass to the top of the cliff, and then falling over it were carried to the eastern, the centre, and the western chamber. Lieutenant Hutchinson, of the Royal Engineers, had the command of the three batteries, and it was arranged that when he fired the centre, Mr. Hodges and Mr. Wright should simultaneously fire the eastern and the western batteries, to ensure which they had practised at them for several previous days. The wires were each 1,000 feet in length, and it was ascertained by experiment that the electric fluid will fire powder at a distance of 2,300 feet of wire. After the chambers were filled with powder, the galleries and passages were all *tamped* up with dry sand, as is usually the case in all blasting operations.

At 9 o'clock in the morning a red flag was hoisted directly over the spot selected for the explosion. The wires were then tested by the galvanometer, the batteries were charged, and every arrangement was completed for firing them.

It was arranged that the explosion should take place at 2 o'clock; at that time there was an immense concourse of people assembled. In a marquee erected near the scene of operation, for the accommodation of the directors and distinguished visitants, we observed among the number assembled, Sir John Herschell, General Pasley, Col. Rice Jones, Mr. Rice, M.P., Professors Sedgwick and Airy, the Rev. Dr. Cope, and there was also a strong muster of engineers, among whom were Mr. Tierney Clark, Mr. John Braithwaite, Mr. Charles May, Mr. Lewis Cubitt, and Mr. Frederick Braithwaite; the engineers and directors of the Greenwich, Croydon, Brighton, and South Eastern Railways, besides numerous foreigners of eminence.

At 10 minutes past 2, Mr. Cubitt, the company's engineer in chief, ordered the signal flag at the western marquee to be hoisted, and that was followed by the hoisting of all the signal flags. A quarter of an hour soon passed in deep anxiety. A number of maroons, in what appeared to be a keg, was rolled over the cliff, and on its explosion with a loud report, all the flags were hauled down. Four more minutes passed away, and all the flags except that on the point to be blasted were again hoisted. The next minute was one of silent, and breathless, and impatient expectation. Not a word was uttered, except by one lady, who, when too late, wished to be at a greater distance. *Galeatum sero duelli pœnitet.* Exactly at 26 minutes past 2 o'clock a slight twitch or shock of the ground was felt, and then a low, faint, indistinct, indescribable moaning subterranean rumble was heard, and immediately afterwards the bottom of the cliff began to belly out, and then almost simultaneously about 500 feet in breadth, with reference to the railway's length of the summit began gradually to sink.

There was no roaring explosion, no bursting out of fire, no violent and crashing splitting of rocks, and what was considered extraordinary, no smoke whatever; for a proceeding of mighty and irrepressible force, it had little or nothing of the appearance of force. The rock seemed as if it had exchanged its solid for a fluid nature, for it glided like a stream into the sea, which was at a distance of about 100 yards—perhaps more—from its base, tearing up the beach in its course, and forcing up and driving the muddy substratum together with some debris of a former fall, violently into the sea, and when the mass had finally reached its resting place a dark brown colour was seen on different parts of it, which had not been carried off the land; the shattered fragments of the cliff are said to occupy an area of 15 acres, but we should judge it to be much less. I forgot to minute the time occupied by the descent, but I calculate that it was about four or five minutes. The first exclamations which burst from every lip was—"Splendid, beautiful!" the next were isolated cheers, followed up by three times three general cheers from the spectators, and then by one cheer more. These were caught up by the groups on the surrounding downs, and, as I

am informed, by the passengers in the steam boats. All were excited—all were delighted at the success of the experiment, and congratulation upon congratulation flowed in upon Mr. Cubitt for the magnificent manner in which he had carried his project into execution.

As a proof of the easy, graceful, and swimming style with which Round Down Cliff, under the gentle force and irresistible influence of Plutus and Pluto combined, curtseyed down to meet the reluctant embraces of astonished Neptune, I need only mention that the flagstaff, which was standing on the summit of the cliff before the explosion took place, descended uninjured with the fallen debris.

No fossil remains of the slightest importance were brought to light, which was a matter of disappointment to many. A very few even of the most ordinary character were found among the mass, which it may well be imagined was soon after the explosion, teeming with the curious multitude from the cliffs above anxious to obtain some relic of the event.

On examining the position occupied by the debris of the overthrown cliff, we were much pleased to find it more favourably disposed than we could have conceived possible. Instead of occupying the site of the proposed railway at the foot of the cliff, it had by its acquired velocity slid past it, and left comparatively little indeed to be removed. At some considerable distance from the cliff, the fragments appeared to be heaved up into a ridge, higher than any other part, forming a small valley towards the cliff, and another seaward, beyond which a second ridge appeared, when it finally slopes off towards the sea. The chalk was by no means hard, and appeared thoroughly saturated with water. The great bulk of the fragments ranged from about 2 to perhaps 8 or ten cubic feet, although we observed a vast number of blocks, which contained from two to three cubic yards and upwards, one of which was driven some distance into the Shakespeare Tunnel, without doing injury to the brickwork. There was very little, indeed, of what might be termed rubbish in the mass.

Previous to the explosion, we had heard it stated that about a million yards were expected to be detached; indeed the Railway Times so stated it, on the 21st ultimo, apparently from authority, and after the explosi n took place, it was publicly asserted by one of the officials, that three quarters of a million of cubic yards had come down. Now, on cubing the stated dimensions of the mass, which were given as under 300 feet in height by, say 50 feet longer than the gallery, which would therefore be 350 feet, by an average thickness or depth from the face of the cliff of 60, we shall have 233,333 cubic yards; but as the present face slope of the cliff is greater than before, the average thickness perhaps might be increased to 75 feet, which would make the quantity 291,666 cubic yards, from this is to be deducted 50,000 yards, the estimated quantity to be now shifted in forming the road, we shall then have 30,000 yards effectively removed by the expenditure of one ton of powder. We understand that Mr. Cubitt, the engineer, afterwards stated that a saving of six months' work, and £7000 expenditure was effected by this blast. Now allowing 6*d*. per yard for the removal of the quantity now required to be shifted, which would amount to £1250, and £500 for the powder used in the blast, the cost of forming the galleries, tamping, &c. &c., we shall find that this mass has been removed at a cost of 1.44 pence per yard. Again, taking Mr. Cubitt's statement, that a saving has been effected of £7000, to which, if we add the £1750, expenditure by the present plan, we shall find that he estimated the cost of removal by hand labour, at rather less than 7½*d*. per yard.

We felt an interest in examining the beds and fissures of the chalk in the neighbourhood of this blast, which clearly indicated that the plan of removal adopted by Mr. Cubitt, was not only the cheapest, but the safest method which could have been adopted. The vertical fissures which here traverse the chalk appear to lie pretty nearly parallel, and at a slope perhaps of one-fifth to one-tenth to one. It was in one of these fissures that the whole mass parted and slipped down, on which we believe it had set previously, no doubt brought about by the infiltration of water more than the sapping of the base by the sea. So treacherous indeed was this chalk, that if we are rightly informed, a mass equal nearly in bulk to that blasted on Thursday came down unexpectedly some time since in the night time, burying in its ruins a watchman or foreman belonging to that part of the line. In the zigzig gangways cut along the face of the cliff, to enable persons to ascend to the summit—this sliding of the chalk where those vertical fissures are intersected, appears very frequently, inspiring the passer-by with a feeling of great insecurity. How far the water might be intercepted, or otherwise be prevented from filtering through these fissures is a question of great importance, and would not, we think, be one of difficult remedy. It also becomes a matter of interesting inquiry as to the effect which a lesser qantity of powder would have had, deposited and fired in the same manner. Would it only have made the mass insecure, or caused a partial sliding down, rendering it then more difficult of removal by hand than at first? The proportion of powder which Mr. Cubitt employs in his blasting operations we understand is determined thus: "The cube of the line of least resistance in feet, gives the quantity in half ounces;" but in this case there does not appear to have been any such quantity employed, though much more than heretofore is found necessary in usual blasting operations. Perhaps the most curious circumstance, connected with the operation, was the apparent absence of shock on the firing of the charge on some spots in the immediate vicinity, while at other, far more distant, it was clearly perceptible. Thus where the batteries were placed, those in charge of them thought the charge had missed fire, from their being insensible to any shock, while at five times the distance along the face of the cliff, it was clearly felt. But even along the face of the cliff it was very evident that the shock was felt by some and not by others, though standing within a few yards of each other.]

Fig. 1.—Section of the Cliff.

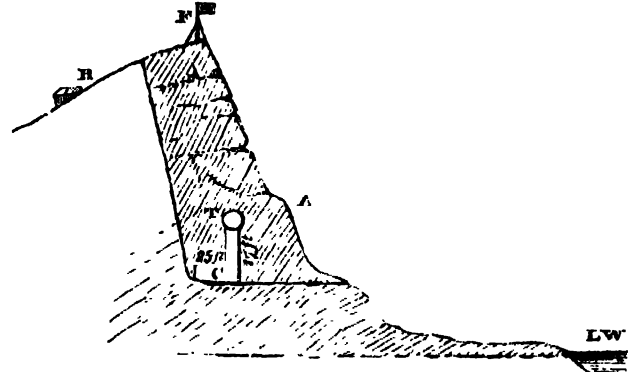


Fig. 2.—Section showing the movement of the mass.

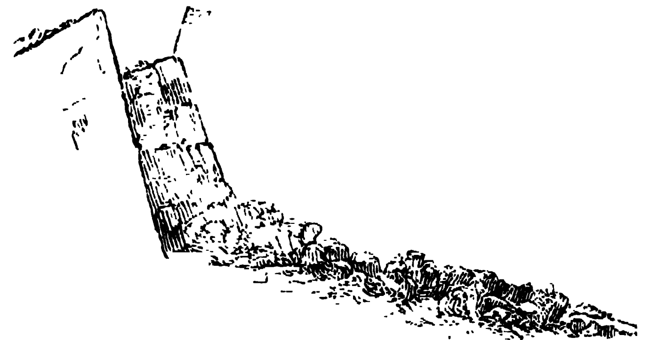


Fig. 3.—Plan of the Cliff and Chambers.

A B C

Reference.

Fig. 1.—Section of Cliff before the explosion; H house in which the batteries were placed, F flag over the spot, T tunnel or heading, C one of the chambers, L R level of proposed railway, L W level of low water.

Fig. 2.—Section showing the movement of the mass.

Fig. 3.—Plan showing the projection of the cliff; the heading T, and chambers A in which 50 barrels of gunpowder were placed, B 70 barrels, and C 60 barrels.

Neapolitan Steamers.—We lately had the pleasure of attending the trial of two steam vessels, named the *Rondine* (Swallow), and the *Antelope*, built at Northfleet, by Mr. Pitcher, for the revenue service of his Neapolitan majesty. The engines of both vessels are manufactured by Messrs. Boulton, Watt, and Co. These vessels are of similar dimensions, in fact built from the same drawing, and are in length between perpendiculars, 100 feet; keel for tonnage, 90 feet, 5 inches; extreme breadth, 16 feet; moulded breadth, 15 feet 5 inches; depth in hold, 9 feet 6 inches; tonnage, O.M., 123$\frac{1}{94}$; displacement as launched, 65 tons; ditto, complete with 23 tons of coals, 145 tons. Draft at this, 7 feet 3 inches. Immersed section, 91 feet. Speed

at measured mile = 9 miles per hour. Although the *Rondine* and *Antelope* are of the same capacity, they differ in the construction of their motive powers: the former, the *Rondine*, having beam engines, the *Antelope*, oscillating or vibrating cylinder engines, both of the power of 40 horses. Cylinders 26¾ in. diameter, stroke, 2.6, and 34 strokes per minute. The beam engines are of the usual construction, as designed by Boulton and Watt in 1818. The various parts are reduced in strength as experience and improved manufacture dictates; we perceive they have in this case abolished the headstock framing, substituting pillars and an entablature, secured longitudinally by strong deck or paddle beams, they are continued through the side, supporting the ends of the paddle shafts, so that they have no connexion with the spring-beam or frame of the paddle-boxes, thereby preventing tremulous motion. This arrangement is by no means new, yet greatly to be recommended and will shortly be applied to a vessel of 300 horse power. The oscillating engines of the *Antelope*, in *arrangement*, are similar to those of the *Virago*, published in the *Journal*, June 1841, Vol. IV., each engine having its air-pump and condenser—the former worked by a small beam connected with the cranked intermediate shaft. It may be mentioned as an argument in favour of oscillating engines (of moderate power), that in these cases there is a saving of five feet in length of engine-room, and in weight of about six tons. These engines occupy a space of 10 feet athwart, and five feet fore and aft. The small amount of the former arises from the combination of the parts, and must be advantageous in its application to vessels of narrow beam. The boilers in both cases are of the common flue kind, weighing 7½ tons; or, with its apparatus and water (the latter five tons), 11½ tons; the engines weigh 16 tons, making a total of 27½ tons complete. Both these vessels are fitted with a disengaging apparatus for the paddle wheels, so that they may be connected with, or detached from, the engines at pleasure, which, as well as the engines of the *Antelope* are the subjects of a patent lately granted to Mr. James Brown, of the firm of Boulton, Watt, and Co.

THE GREAT NORTHERN STEAM-SHIP.—This magnificent ship arrived off Blackwall at the beginning of last month, and has since taken up a berth in the East India Import Dock. The Great Northern has been built within the last 12 months at Londonderry, by Captain Coppin, of that place. She is a fine specimen of naval architecture. She is fitted with Mr. F. P. Smith's patent screw propeller. Her dimensions and power are given in the *Journal* for July last, p. 243, Vol. V., under the head of "The *Monster* Steam-Ship."

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM DECEMBER 28, 1842, TO JANUARY 28, 1843.

Six Months allowed for Enrolment, unless otherwise expressed.

Alonzo Grandison Hull, of Clifford Street, Middlesex, doctor of medicine, for "*improvements in electrical apparatus for medical purposes, and in the application thereof to the same purposes.*"—Sealed December 28.

Thomas Thompson, of Coventry, weaver, for "*improvements in weaving figured fabrics.*"—Dec. 28.

Henry Crosley, of the city of London, civil engineer, and George Stevens, of Limehouse, gent., for "*improvements in the manufacture of sugar, and the products of sugar.*"—Dec. 28.

Edward Thomas, Lord Thurlow, of Ashfield Lodge, Ipswich, Suffolk, for "*an improvement or improvements on bits for horses and other animals.*"—Dec. 29.

Benjamin Bailey, of Leicester, frame-smith, for "*improvements in machinery employed in the manufacture of stockings, gloves, and other frame-work knitted fabrics.*"—Dec. 29.

John Stephen Bourlier, of Sherborn Street, Blandford Square, engineer, for "*improvements in machinery used in printing calicoes, silks, paper hangings, and other fabrics.*" (A communication.)—Dec. 29.

Joseph Rock, Jun., of Birmingham, factor, for "*improvements in the construction of locks.*"—Dec. 29.

Henry Samuel Rush, of Sloane Street, mechanic, for "*for improvements in apparatus for containing matches for obtaining instantaneous light.*"—Dec. 29.

Baron Victor de Wydroff, of old Bracknell, Berkshire, for "*improvements in the construction of railways and in wheels to run on railways, and in apparatus for clearing the rails.*"—Dec. 29.

John Bishop, of Poland Street, Westminster, jeweller, for "*improvements in apparatus for portioning steam power; and also improvements in plugs, cocks, or taps for steam gases and liquids.*"—Dec. 29.

Crawshay Bailey, of Nant-y-Glo iron works, Monmouth, Esq., for "*improved constructions of rails for tramways and railways.*"—Jan. 11.

James Harvey, Jun., of Regent Street, goldsmith, for "*improvements in steam engines.*" (A communication.)—Jan. 11.

William Ritter, of 106 Fenchurch Street, gentleman, for "*improvements in crystallizing and purifying sugar.*" (A communication.)—Jan. 11.

Julien Edward Disbrowe Rodgers, of Upper Ebury Street, chemist, for "*improvements in the separation of sulphur from various mineral substances.*"—Jan. 12.

William John Loat, of Clapham, builder, for "*an improved mode of constructing floors and roofs.*"—Jan. 12.

Pierre Armande Comte de Fontain le moreau, of Skinner's Place, Sise Lane, for "*process or processes of combining clay with some other substances for the producing of a certain 'ceramic paste,' capable of being moulded into a variety of forms, and the application thereof to several purposes.*" (A communication.)—Jan. 14.

James Harvey, of Bazing Place, Waterloo Road, timber merchant, for "*improvements in paving streets, roads, and other places.*" (Partly a communication.)—Jan. 14.

William Snell, of Northampton Square, gentleman, for "*improvements in machinery for the manufacture of farina.*"—Jan. 14.

Nathaniel Card, of Manchester, candle-wick manufacturer, for "*improvements in the manufacture of candlewicks, and in the machinery or apparatus for producing such manufacture.*"—Jan. 14.

Henry Hussey Vivian, of Singleton, Glamorgan, Esq., and William Gossage, of Birmingham, manufacturing chemist, for "*improvements in heating or reducing ores of zinc; also for improvements in furnaces to be used for reducing ores of zinc, part of which improvements are applicable to other furnaces.*"—Jan. 14.

James Hamer, of Wardour Street, engineer, for "*improvements in propelling vessels.*"—Jan. 19.

Thomas, Earl of Dundonald, of Regent's Park, for "*improvements in rotatory or revolving engines, and in apparatus connected with steam engines, and propelling vessels.*"—Jan. 19.

Joseph Kirkman, Jun., of Soho Square, pianoforte manufacturer, for "*improvements in the action of pianofortes.*"—Jan. 19.

Thomas William Bennett, of Gray's Inn Road, timber merchant, for "*improvements in paving or covering roads, streets, and other ways and surfaces.*"—Jan. 19.

Luke Hebert, of Dover, civil engineer, for "*improvements in machines for grinding, and for dressing or sifting grain, and other substances.*"—Jan. 19.

William Bates, of Leicester, fuller and dresser, for "*improvements in the dressing and getting up of hosiery goods, comprising shirts, drawers, stockings, socks, gloves, and other looped fabrics, made from merino, lambs' wool, worsted, cotton, and other yarns, and in machinery for raising the nap or pile in the same.*"—Jan. 6.

Thomas Sunderland, of Albany Street, Regent's Park, Esq., for "*improvements in moving floating bodies through water and air, and in accelerating the flow of water, air, and other fluids, through shafts, pipes, and other channels.*"—Jan. 19.

Uriah Clarke, of Leicester, dyer, for "*improvements in framework-knitting machinery, and a new kind of framework-knitted fabric.*"—Jan. 21.

Frederick Albert Winsor, of Lincoln's Inn Fields, barrister-at-law, for "*new apparatus for the production of light.*" (A communication.)—Jan. 26.

Charles Frederick Bielefeld, of Wellington Street, North Strand, papier-maché manufacturer, for "*improvements in suspending or hanging swing looking glasses and other articles requiring like movements.*"—Jan. 26.

William Palmer, of Sutton Street, Clerkenwell, manufacturer, for "*improvements in the manufacture of candles.*"—Jan. 26.

Henry Chapman, of Arundel Street, Strand, for "*a fabric for maps, charts, prints, drawings, and other purposes.*"—Jan. 26.

Frances M'Gretrick, of Ernest Street, St. Pancras, artisan, and Matthew Bailey Tennant, of Henry Street, Regent's Park, gentleman, for "*improvements in apparatus for preventing engines and carriages from going off railways, and for removing obstructions on railways.*"—Jan. 26.

Edward Smallwood, of North Lodge, Hampstead, gentleman, for "*improvements in covering roads, ways, and other surfaces.*"—Jan. 26.

Robert Goodacre, of Ullesthorpe, Leicester, gentleman, for "*improvements in weighing apparatus applicable to cranes or other elevating machines, whereby the weight of goods may be ascertained while in a state of suspension.*"—Jan. 26.

James Boydell, Jun., of Oak Farm Works, Dudley, Stafford, iron master, for "*improvements in the manufacture of metals for edge tools.*"—Jan. 26.

George Parker Bidder, of Great George Street, Westminster, civil engineer, for "*an improved mode of cutting that kind of slates, commonly called roofing slates, though sometimes used for other purposes.*"—Jan. 26.

William James Greenstreet, of Blackfriars' Road, gentleman, for "*improvements in machinery or apparatus for producing or obtaining motive power.*"—Jan. 26.

Joseph Kirby, of Banbury, Oxford, gentleman, for "*improved apparatus for manufacturing bricks, tiles, and other articles from clay or earthy materials.*"—Jan. 26.

George Phillips Bayly, of 146, Fenchurch Street, brush maker, for "*improvements in brushes.*"—Jan. 26.

Henry Phillips, of Exeter, chemist, for "*improvements in removing impurities from coal gas for the purposes of light.*"—Jan. 26.

Martyn John Roberts, of Brynycaeran, Carmarthen, Esq., for "*improvements in dyeing wool and woollen fabrics.*"—Jan. 26.

William Weild, of Manchester, Engineer, for "*improvements applicable to window blinds and curtains, part of which improvements are also applicable to doors.*"—Jan. 28.

David Isaac Wertheimber, of West Street, Finsbury Circus, gentleman, for "*improvements in calculating machines, part of which improvements is applicable to purposes where wheelwork is required.*"—Jan. 28.

John Barrow, of East Street, Manchester Square, engineer and smith, for "*improvements in the manufacture and hanging of window sashes.*"—Jan. 28.

ADVERTISEMENTS.

THE THAMES TUNNEL

OPEN TO VISITORS DAILY (Sunday excepted) from Nine A. M. until 5 P. M., and is brilliantly lighted with Gas. The entrance for a short time longer is only on the Middlesex side of the River, and near the Tunnel Pier at Wapping, the Rotherhithe entrance being closed, to finish the new Staircase, and make that shaft available as a thoroughfare for foot passengers. Admittance 1s. each.

By order of the Board of Directors.
J. CHARLIER, Clerk of the Company.
Company's Office, 2, Walbrook Buildings, City, Jan. 1843.

N.B.—Steam Boats to the Tunnel Pier at Wapping, from Hungerford, Adelphi, Temple Bar, Blackfriars Bridge, Old Shades, Old Swan, and Adelaide Piers, London Bridge, at every hour.

LITHIC ANTI-CORROSION PAINT, long known for its durable qualities in all climates as a cheap out-door paint for covering Brick Wood, or Iron. Manufactured in Stone or Slate Colours by J. B. WHITE and SONS, Millbank Street, Westminster, Roman Cement Manufacturers.

THE Directors of the PARISIAN BITUMEN PAVING COMPANY beg to call the attention of Engineers, Architects, Surveyors, Builders and the Public to the price at which they will undertake to lay down their Bitumen, and to its applicability for pavements, roofs, lining tanks &c., also to the successful use of it as a cement in the Weirs on the Upper Medway, whereby great economy in the primary construction and future repairs are attained. The prices are as follows:—

Bitumen prepared for cement per ton	£3	0s.	0
Covering viaducts or arches of bridges, catacombs, vaults, terraces, &c., to exclude damp, 1½ inch thick, per superficial yard	0	4	6
Paving pathways, granaries, warehouses, &c., 1½ inch thick, per square yard	0	4	6
Paving barns, court yards, tun rooms, wharfs, stables, &c., 2 inches thick, per ditto	0	5	6

The above charges do not include the cost of carriage, which must be borne by the parties by whom the work is required.

The Directors are willing to guarantee the durability and efficiency of any work executed by them.

The Directors take leave to inform their numerous friends and the public, that offices are established at 4, Great Winchester-street, Broad-street, for the city, and at 8, Denbigh-street, Belgrave-road, for the west end and its vicinity, where every information will be promptly given. Mill Wall, Poplar.

PATENT TRANSPARENT VENTILATORS.—The increasing patronage afforded to this invention, which has been extensively introduced into the palaces, public offices, most of the principal banking and club houses, and many private houses, warehouses, offices, &c., has induced the proprietors (FAIRS & Co.) to an effort for their more general adoption; in furtherance of which they have prepared a graduated and greatly reduced tariff of prices, which will be forwarded, post-paid, on application to Fairs and Co., 22, Mortimer-street, Cavendish-square; the Factory, 15, Gillingham-street, Pimlico; or Messrs. Bunnett and Corpe, 26, Lombard-street, where orders are also received. Fairs and Co. are also Manufacturers of the Improved Zinc-Sashes, now so extensively used for churches and other buildings, which supersede the use of copper, at a much less cost, and in which the most elaborate designs may be executed.

J. FINDON'S PATENT IMPROVEMENTS IN

WATER CLOSETS consist in the great Facility of Acting, Cleanliness, Durability, and readiness of being connected to a pipe from a head of water, which pipe may be used for any other purpose; the whole of the apparatus being under the seat. Testimonials may be seen at the manufactory, 190½, High Holborn.

Servants' closets with basin and trap, 25s., with enamelled iron basin, 30s. Cast iron cisterns, 100 gal. 3*l*. 10s., 60 gal. 2*l*. 10s., 38 gal. 1*l*. 10s.

WATER WHEELS.

TO BE SOLD, BY PRIVATE CONTRACT:—

One 50-feet Water-wheel, 4 feet on the breast.		
One 48-feet	do.	3 feet 3 inches on the breast.
One 40-feet	do.	3 feet 9 inches —
One 36-feet	do.	2 feet 8 inches —

Apply to Mr. W. RICHARDS, Redruth, Cornwall, who has also FOR SALE, an excellent 85-inch cylinder ENGINE, and several 15, 16, 17, 18, 19, and 20-inch PUMPS.—Redruth, September, 24.

MARTIN'S Patent Fire Proof and Ornamental Cement is harder and more durable than any Cement hitherto known; has successfully stood the test of seven years trial, indurates with age, and is not subject to any eruption or efflervescence. Houses stuccoed with it become impervious to damp, and impenetrable by fire and vermin. Mosaic imitation marble, floors, walls, and all architectural and interior fittings, for which wood is commonly used, are worked in it with superior delicacy and greater economy. May be obtained in any quantity, at 4s. per bushel of 60 lbs. net for the first quality, and 3s. for the second, of Martin and Co., 8, Hungerford Wharf, to whom all communications are to be addressed.

KEENE'S PATENT MARBLE CEMENT.

THIS Cement, which exceeds all others in hardness, is intended for interior uses where strength and dispatch in execution are required. From the smoothness of its surface, it is an advantageous substitute for wood in its application to skirtings, architrave mouldings, &c., as it resists the action of fire, and is impervious to vermin.

For the Flooring of Entrance Halls, Offices, Churches Chapels, &c., it will be found to be warmer and materially cheaper than stone, from which it is hardly to be distinguished either in hardness or appearance.

When used as mastic, for repairs and alterations, it dries rapidly, and may be painted on within a few days.

The best white quality takes a brilliant polish, and the Scagliola manufactured from it, is allowed to excel all other imitations of marble in richness and depth of colouring.

This material is now being extensively used in Government and other works both public and private, to which the patentees can with confidence refer.

Patentees and Sole Manufacturers, J. B. WHITE & SONS.
Millbank-street, Westminster.

Agents for its sale are established in Liverpool, Manchester, Edinburgh, Dublin, Cork, and the principal towns in the United Kingdom.

MR. GRAYSON'S ARCHITECTURAL SCHOOL OF DESIGN established above Fifty Years.—CIVIL ENGINEERS, MILLWRIGHTS, and others taught the principles of MACHINERY and PRACTICAL PERSPECTIVE. The selection of models and casts accompanying the diagrams which are introduced at this Academy will be found of great utility to the Student in elucidating the several Mechanical and Practical Sciences. Morning classes from 9 to 2; evening from 6 till 9, five nights in the week. For terms apply at 1, Banner-street, Finsbury-square; if by letter, post-paid.

BUNNETT AND CORPE,

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No. 26, LOMBARD STREET, LONDON,

PATENTEES OF REVOLVING IRON SHUTTERS,

and of

IMPROVED BRASS AND ZINC SASH BARS AND MOULDINGS, FOR SHOP FRONTS,

Which are greatly superior to, and much cheaper than any other article for similar purposes.

STALLBOARD PLATES and every description of BRASS WORK for the Trade.

Estimates given, and contracts taken for PATENT IRON SHUTTERS, METALLIC SHOP FRONTS, SASHES, &c., glazed complete with best plate glass, in any part of the kingdom.

Several capital HIGH-PRESSURE STEAM ENGINES to be Sold, or Let on Hire, with boilers, &c. complete, SAWING AND OTHER MACHINERY on new and improved principles, especially adapted for Building purposes. The foregoing may be seen in daily operation at the Patentee's works DEPTFORD, KENT.

*** Agents for FAIRS & Co.'s Patent Transparent Ventilators

OTTIS' (of New York) STEAM EXCAVATOR. Elevations, Plans, and Working Details complete, to a large scale of this Machinery. Also the same complete of the Three Patterns of the STEAM PILE DRIVER may be seen and copies had, on application at my Office, (from 10 to 4).

5, Hungerford Street, Strand. GEORGE SPENCER,
28th Dec. 1842. Mechanical and Engineer's Draftsman.

BY HER MAJESTY'S ROYAL LETTERS PATENT.

GERISH'S PATENT DOOR-SPRINGS, FOR CLOSING EVERY DESCRIPTION OF DOOR: Manufactory, 16, East Road, Hoxton New Town.

These springs consist of parallel and rising hinges in Brass or Iron, and swing centres for doors opening both ways.

These improved spring-hinges or door-springs merit general attention, as they can be applied to any door, in every situation, without defacing the wood-work; their action is easy and noiseless, neat and not visible when the door is shut, and are made to surpass the best now in use for nearly one half the price; they allow the door to go quite back, and are not likely to get out of repair.

The Swing Centre possesses in a simple combination of power double the strength of any hitherto invented in a much smaller size, and at little more than half the expense.

TO MERCHANTS, GAS COMPANIES, AND OTHERS.

A STOCK OF RUSSELL'S PATENT WELDED TUBES, for Gas, Water, and Steam, with Fittings of every description, kept at Sturland's Wharf, City Basin.

EDMUND BURNS, 35, Stanhope Street, Regent's Park, Agent for John Russell and Son, Wednesbury.

N.B. Hot Water Tubes made to bear a pressure of 5000 lb on the square inch. Tubes for locomotive Boilers made in a superior manner.

ENGINES OF H. M. STEAM SHIP "VULTURE."

By Wm. Fairbairn & Co., Millwall Works, London.

(With two Engravings, Plates II and III.)

The general arrangement of these engines will be apparent, from an inspection of the accompanying engravings. Their chief peculiarity consists in the arrangement of the parallel motion, and the manner in which it is made available for working the air-pump. The four main parts of each engine, viz., the cylinder, slide valves, condenser, and air-pump, form a square, and thus occupy the least possible area. With a speed of 220 feet per minute, and an effective pressure of 7 lb. on the square inch, according to the regulation of the Admiralty engineer officers, the power will be 238 horses for each engine, or 476 horses collectively. The space occupied by the engines is 12 feet 3 inches fore and aft, and 19 feet athwartships, and the total length of the engine room is 52 feet 8 inches, with boilers calculated for the full power of the engines; and 59 feet 8 inches, with stowage for 440 tons of coal.

The leading dimensions and proportions are as follow—the letters refer to the engravings.

A, Cylinder, 80¾ in. diameter.

B, Crank, 2 ft. 10½ in. from centre to centre.
Length of stroke, 5 ft. 9 in.

C, Piston Rod, 8¼ in. diameter.

D, Piston, with metallic packing rings, and steel springs.

E, Connecting Rod, 8 ft. 7½ in. long, 10 in. diameter at middle, and 9 in. diameter at ends.

F, F, Base plate, cast in two parts, one for each engine, and firmly joined in the middle. It projects equally on both sides of the crank shaft, and takes hold of the ship for the length of 17 ft. 6 in.

G, G, Wrought Iron Columns, 7 in. diameter, keyed into sockets on the base plate, and rising through sockets cast on the cylinder, to carry the entablature. The sockets on the cylinder are bored out to fit the columns, but allowed to rise or fall with the elongation or contraction of the cylinder.

H, H, Entablature, supported by the wrought iron columns G, G. It is attached by bolts *a a*, to the engine beams *b b*, and these bolts run through to the main paddle-beams *c c*; diagonal trussing being introduced between these beams.

I, I, Wrought iron cross stays, with the sockets *d d* forged in one piece. These sockets are bored out to fit the columns which pass through them, and are fastened with a cotter.

K, Wrought iron stays.

L, Shaft, fixed in a boss on the wrought iron stays K, and on which the beams *e e* vibrate to work the air-pump, these beams being at the same time the radius rods of the parallel motion of the piston rod. On the outer and projecting end of this shaft, the lever *f f* for working the valves also vibrates.

M, Crank Pin, 11 in. diameter.

N, N, Slide Valves, 14 in. length of travel; 8$\frac{9}{10}$ in. breadth of space.

O, O, Cylinder Ports, 40 in. long by 5⅝ in. broad, and ⅝ in. open to the steam when the engine is on the centre; they are opened equally for the ascending and descending strokes, as the engine is balanced by other means.

P, Condenser, cubic contents 103 ft; *g*, foot valve, *h h*, injection pipes with Kingston's valves, *k*, sea injection cock, *l*, bilge injection cock.

Q, Air Pump, 45 in. diameter.
Ditto length of stroke 2 ft. 10½ in.
Air pump rod, cased with brass, 5⅞ in. diameter.

R, Feed and Bilge Pumps.

S, Paddle shaft, 15¾ in. diameter of necks.

T, Eccentric.

U, Starting gear, power as 15 to 1.

V, Equilibrium Expansion Valve; *i*, cam for working expansion valve.

W, Waste water pipe and delivery pipe.

X, Steam pipe to each cylinder 17½ in. bore.
Paddle wheels 26 ft. 6 in. diameter to extremity of floats.
Ditto, floats 8 ft. 9 in. long. Each float in two parts, and each part 13 in. broad.
Boilers four in number placed back to back, 23 ft. 2 in. total length, 26 ft. 10 in. total breadth, and 13 ft. high.

m, m, Shut off valves for steam, to connect or disconnect the boilers.

n, n, Safety valves, one on each boiler, with levers in the engine room to ease off the weights.

o, o. Vacuum or reverse valves.

p, p, Blow off cocks, one to each boiler, with Kingston's valves.

r, r, Man-holes to boilers.

s, Chimney, 5 ft. 10 in. diameter, and 44 feet high above steam-chest, with double external casing.

t, Waste steam pipe, 17 in. bore, with internal pipe for condensed water.

A CHAPTER ON CHURCH-BUILDING.

Being Comments on some Opinions thereon recently published.

By George Godwin, F.R.S., &c.

The Anglican church for some years past, if it may be said without apparent want of respect, has neglected her duties. Zeal was wanting on the part of her ministers, and luke-warmness, if nothing worse, was the result on the part of the congregations. To remedy this evil, many good and learned men have lately worked sedulously, and have succeeded in raising a very different feeling from that which existed before on the subject. Whether, as is often the case after a violent re-action, an evil of an opposite character may be caused—whether the freshly excited zeal has not, or may not, outrun discretion, it would not become the writer to inquire in this place: his business is simply with one result of the present state of opinion.

With greater attention to the rites and ceremonies of religion, has come, very properly, greater regard for the buildings in which they are celebrated. The text, "Is it time for you, O ye, to dwell in your cieled houses, and this house lie waste?" has been powerfully commented on in numerous places, and has been put forth in various shapes; while at both our Universities, as well as in many other quarters, societies have been established, whereof the clergy are the chief supporters, for the improvement of church architecture, and for the preservation, and the proper restoration, of ancient models. This has led to a corresponding increase of attention to the subject, on the part of the professors of the art; the principles of pointed architecture (the ecclesiastical architecture of our forefathers), have been investigated, and much sounder views have been arrived at than were before general: so that not to mention what has been already done, we may anticipate, without fear of disappointment, an important improvement in every new church that may hereafter be erected.

One of the points dwelt on at considerable length by recent ecclesiological writers, is, the *symbolism* of church architecture, the fact that every ancient ecclesiastical building was intended to convey numerous sacred truths by its form and arrangement,—and the consequent deduction that *ritualism* should be carefully studied by all those who may be called on to design churches.

A general outline of their views in this respect, regarding a church as deduced from ancient buildings remaining to us, may be thus stated. A chancel and a nave are the essential parts of a church; the latter is the representative of the church militant, the former of the church triumphant. The chancel-arch, which defines and separates the two (and is never to be omitted) images the close of our life. The entrance to the sacred structure should be at, or as close to, the west-end as possible, and the font must be placed near it, typical of our entry to the church militant by baptism.

When ailes can be added to the nave, the edifice becomes more perfect, as, apart from the increased accommodation, the three parallel divisions so formed, serve in continuation of the symbolical system, to set

forth the Holy Trinity, to which numerous other references are ever found, in the windows and tracery of ancient ecclesiastical buildings. In a cruciform church, the best form, but to be adopted only when funds are plentiful, the four arches at the junction of the nave, chancel, and transept, symbolise that by the writings of the four Evangelists, the doctrine of the cross is taught to the four quarters of the world. Further, on the altar are to appear two candles, to signify that "Christ is a light to lighten the Gentiles, and the glory of his people Israel."

Now, that it is wise and proper to enforce this system so strongly and so constantly as has been done—to render matters of this description all-important—we should be quite unwilling to assert. We would give all "the aid which slackening piety requires;" we would not

"— — — conceal the precious cross
Like men ashamed: the sun with his first smile
Shall greet that symbol crowning the low pile:
And the fresh air of incense-breathing morn
Shall wooingly embrace it; and green moss
Creep round its arms thro' centuries unborn.'

We would place

'Our Christian altar faithful to the
Whence the tall window drinks the

We would most worthily adorn the house of God, to render it to the extent of our means fitting for its high purpose—but at the same time we would carefully avoid all proceedings, however agreeable to our temperament, however enticing to us as an artist, which should give undue importance to bricks and stones, and man's inventions and devices, which should increase the number of ceremonial observances, which should threaten to exalt the shadow in the place of the substance, and so lead to a state of things which did once result from such a course, and may result again, notwithstanding the increased amount of information possessed, and the general comparative enlightenment.

Relative to the size of the chancel, the Cambridge writers say, it "should not be less than a third, or more than the half, of the whole length of the church. The larger it is made within the prescribed bounds, the more magnificent will be the appearance of the building."[1] Into this portion of the structure, none but those engaged in the ceremonies are to enter; and here the whole of the service is to be performed with the exception of the sermon. The north side of the chancel-arch is pointed out as the best position for the pulpit. It seems to us, and we say it with the greatest deference, that a deep chancel, such as is here insisted on, however magnificent and striking it may, and does, make a building, is unsuited to the Protestant service as it has been *heretofore* performed. The fact is evident in an examination of the arrangements made in the majority of our cathedrals, wherein, if the service were read in the chancel, so to term it, and the worshippers were confined to the nave, nothing said by the priest at the altar could possibly be heard by them. In ordinary sized parish churches too, if the chancel were one-third the length of the building, and still less if half, the majority of priests would fail to make themselves heard, unless indeed the altar were placed at the west-end of it, with a reredos or screen, to rail off the remainder of the chancel. The use of the rood-screen, still further to separate the laity from the clergy, which is strongly insisted on, would throw an additional impediment in the way. *If it be not necessary* that the service should be heard and understood, and into this inquiry we will not venture to go, then of coruse the objection vanishes. The very occurrence of this question in the mind, however, serves to explain why the architectural works to which we have referred, are termed by some, "engines of polemical theology."

Writers of the Roman Catholic faith insist on the inconsistency of the position held by Protestant divines, who urge this and other opinions relative to the form, arrangement, and decoration of our churches. "The good men who are so earnestly labouring for the revival of Catholic church architecture," says the *Dublin Review*,[2] must be convinced that we must have the Catholic service revived, in the first place, before any real good can possibly be accomplished." This last necessity, (Catholic meaning here *Roman* Catholic,) we deny altogether. The principles of ancient church architecture, as applied to suit one set of circumstances, being studied and understood, may be adapted without difficulty to other, and in this case but slightly modified, circumstances, and made to produce as efficient a result. The remark, however, may possibly be deemed to apply in some degree to those who would bring back all such forms and details as were anciently used, although altogether unsuited to present requirements.

The antiquity alone, of a practice or form (strong as it makes its claim), would hardly seem sufficient authority in all cases for its revival: thus, (to illustrate our meaning from a different source,) the certainty that the practice of burying in churches is of very ancient date, and its consonance with our feelings, are now not deemed by the majority sufficient reasons for its continuance, the injurious tendency of the custom being fully known.

According to recent writers, nothing is to be done that has not been done before. Fearing the ignorance of modern architectural professors, (a little too imperiously stated, be it remarked, by some of the non-professional writers,) the necessity of having a precedent for every tower, and door, and window, and moulding, is insisted on. Design nothing, copy all, is the deduction which forcibly presents itself. "Inspice et fac secundum exemplar quod tibi monstratum est." This course has safety to recommend it, but will hardly effect for posterity, what our forefathers have done for us.

To rid our churches of close pews and lumbering galleries, and to destroy the opinion, that to accommodate the greatest number of people at the smallest possible cost, is the chief problem to be solved in church building, would be a great achievement. Something has already bee towards this very desirable end, and the work is progressing. The fact once thoroughly understood, that more worshippers may be seated by means of open benches than in pews, will in this utilitarian age, operate more powerfully in leading to their disuse, than any of the other numerous arguments against them which have been advanced. So far as appearance is concerned, there cannot be two opinions on the subject.

As an artist and an enthusiastic, though humble, advocate of the fine arts, the writer cannot regard the present views on church decoration, but with gratification, seeing in them the promise of a noble field for their exercise and development. Less than seventy years ago, Sir Joshua Reynolds, West, Barry, Dance, Cipriani, and Angelica Kauffman, offered munificently to adorn the interior of St. Paul's Cathedral with paintings, with the view of convincing the public of the improvement in our sacred buildings, which might be effected by this means, and so of obtaining an opening for the encouragement of British art. The then Archbishop of Canterbury and the Bishop of London, however, could not be induced to entertain the proposition, on the ground that it savoured of Popery, and the idea was in consequence abandoned. How doubtful of one's own judgment should such marked changes in opinion make us—how tolerant of the sentiments of others should we be, remembering as all must, the different light in which we ourselves have viewed the same circumstances at different epochs, and the alteration which is constantly taking place in our own views and opinions.

In one of the latest publications of the Cambridge Camden Society, containing many very excellent suggestions,[3] it is remarked, "a church is not as it should be till every window is filled with stained glass, till every inch of floor is covered with encaustic tiles, till there is a rood-screen (?) glowing with the brightest tints and with gold; nay, if we would arrive at perfection, the roof and walls must be painted and frescoed." In carrying out such views it is hardly necessary to say, the greatest care must be taken to prevent a theatrical effect likely to result from such a course, unless pursued with great judgment. We

[1] "A few words to Church Builders," 2nd Edition. Published by "Cambridge Camden Society," 1842.

[2] February, 1842.
[3] "Church Enlargement and Church Arrangement."

are disposed to think a more moderate use of colours than has been made in recent restorations in London and Paris, might produce a result equally excellent in an artistical, and more so in a devotional, point of view. Scripture sentences upon the walls, "ywritten full thicke," are amongst the most excellent and fitting adornments of a church.

The increased use made of stained glass in England is exceedingly gratifying, and the excellent specimens which have been prepared lately show clearly, as the writer has on many other occasions asserted, that we could produce stained glass quite equal to anything that was done by our forefathers if proper encouragement were afforded to the professors of the art. Difficult of attainment, expensive in its processes, so much so, indeed, as almost to prevent experimentalizing except for actual commissions, and labouring under the weight of an erroneous opinion that the art was lost, glass-painting had remained for a long time in a very languishing condition. Latterly, however, it has revived considerably, and many large works in various parts of the country are now in progress. The opinion entertained of our want of skill in glass-painting is hardly yet removed. The author of "A few words to Church Builders," says, "stained glass is of much importance in giving a chastened and solemn effect to a church. Those who travel on the Continent might find many opportunities of procuring from desecrated churches, at a very trifling expense, many fragments which would be superior to any we can now make. But if it be modern, let us at least imitate the designs, if we cannot attain to the richness of hues which our ancestors possessed." Against the opinion to be inferred from this, we will venture to place our feeble protest. There is much old stained glass to be found on the Continent inferior to what we can now make, and there is not a great deal which we could not equal if the proper opportunity were afforded. Moreover, we do not believe there are any hues possessed by our forefathers which could not now be produced.

Let every material employed in the construction of a church be *real*, is a wholesome injunction likely to produce excellent results, although, perhaps, some may think it could be carried too far. It has been too much the custom to endeavour to produce a showy and deceptive external appearance, without proper regard to the fitness, propriety, and excellence of all the various parts of the building, which, indeed, have been sacrificed for it. While deal painted to imitate oak, and Roman cement in lieu of stone, give entire satisfaction to ourselves, and obtain the approval of the world, no efforts will be made to obtain that which is better, and a niggardly calculating spirit is engendered, grudgingly giving the "just enough," which is unworthy of Christians, and destructive of more good feelings than one.

In *designing* buildings in the pointed style, this same doctrine cannot be too constantly reflected on. The more fully our ancient edifices are studied, the more clearly does it become apparent that nothing was introduced unnecessarily or deceptively for mere appearance sake—that the excellence of effect, which is apparent, resulted from the use of sound principles, laid down not with the view of producing that effect, but with reference to stability, convenience, and fitness; good taste and great skill being afterwards employed in adorning that which was necessary, and making the Useful a producer of the Beautiful. Plans were not made to accord with a fanciful elevation, entailing thereby loss of convenience, and unnecessary outlay, but were arranged first, to suit the requirements of the time, and upon these naturally the elevation followed. All decoration grew out of the construction, and reason governed instead of caprice. This is now better understood than it was a few years ago, and will doubtless produce its fruit in due season.

The virtual abrogation of the regulation, at one time enforced by the "Incorporated Society for Building Churches," that no timber roof should be used without a tie beam, will do much to restore to modern churches one of the most striking features of ancient buildings—the open arched roof—and is a subject for congratulation. The same may be said of the feeling now fortunately growing, against the tasteless tombs and monumental slabs with which our noble cathedrals and churches have been gradually encumbered and overladen. Like some frightful fungus, they have spread insidiously over all parts of these structures, destroying alike their beauty, propriety, and stability. Our metropolitan Abbey presents a lamentable example of the evil; and it is to be hoped that the acknowledged good taste of those who now govern there, will not merely prevent the increase of this abomination, but lead, as opportunities may from time to time offer themselves, to the removal of the excrescences now deforming that fine building, and to a restoration of its harmonious proportions and original integrity.

To say that every one of our ancient buildings should be most religiously preserved, is perhaps, less necessary now than it was some little time ago; still it cannot be repeated too often, for alas! instances of injury and destruction still occur, and not unfrequently. Full of information, abundant of association, and suggestive of most wholesome thoughts, they are contemporary histories, which once lost, can never be replaced; and in which every alteration even, or interpolation, is an offence against society. They are the visible links which make the past and the present one; they are the standing monuments of the Christian religion, and attest at one and the same time our forefathers' piety and our forefathers' skill.

THE NEW ROYAL EXCHANGE.

Instead of being at all premature, some of the remarks we are about to make come too late to be of the service they otherwise might—that is, supposing suggestions so thrown out to be ever attended to, which may fairly be questioned; for although architects are apt to be not a little sensitive when their productions are animadverted upon, they rarely seem disposed to screen themselves from criticism by attending to, and profiting by, what it has objected to, either in their own works or those of others. It is probable, therefore, that our observations will be of just as much service now, as they would have been if brought forward when they could have been acted upon, at least fully taken into consideration before it had been determined to pursue an opposite course. But with regard to consideration, none at all, as far as we can ascertain, appears to have been given to what was one of the most essential points to be deliberated upon at the very outset, viz. whether the new Exchange should be covered in or not. All we know is that, instead of its being made a question, it seems to have been settled, or rather assumed as matter of course, that it should be a mere open court, such having been the case in the former building. No idea of the possibility of any thing else appears to have occurred to any one—at least not to any one who had a voice in the matter. Yet though we say it should have been made a question for discussion, we do not think there was occasion for much discussion, the advantages of the central area being covered in instead of left open, being so many and so obvious, that merely to specify them would have been sufficient, we think, to carry the decision at once in favour of such plan. What could have been urged in behalf of the contrary mode, the one actually adopted, we cannot even conjecture; therefore, if any arguments at all were adduced in its support or justification, we should be exceedingly glad to learn what they were—which is more, we suspect, than any one can inform us. The only satisfaction then left us, until we are so informed, is the liberty of concluding that, notwithstanding all that was said at the time about the vast importance of the Royal Exchange as "a National Edifice, that should be in every respect worthy of the first commercial city in the world," and much more to the same effect: very little of careful consideration seems to have been bestowed upon it, great as was the delay, and noisy as was the squabbling as to who should be the architect.

Had a thought been given to the matter at the outset, it would probably have been perceived that, even supposing it otherwise mere matter of indifference whether the area were covered in or not, there was a golden argument to turn the scale in favour of its being covered —namely increased rental from the shops on the exterior of the building, in consequence of the greater space that could then have been

given up to them, without at all interfering with the accommodation required for the body of the Exchange. According to Mr. Tite's plan, the entire space occupied by the latter will be about 19,000 square feet, but out of this number, 6500 will be quite open and unsheltered, consequently cannot always be made use of for purposes of business. Now had it been determined that the centre portion of the plan should be covered in, there would have been shelter every where, therefore the breadth of the ambulatories might have been considerably reduced, so as to afford an additional depth of nine or ten feet to the shops—some of which will now not be more than 7 feet in depth, or hardly that. Even then the actual space available at all times for business would have been the same, or rather more than will now be the case. And so far from the architectural effect being at all injured by such contraction of the space behind the columns, it would, in our opinion, be improved, and the whole would, in fact, appear to be more spacious than it is now likely to do; for the width of the cloister portion or ambulatories will now be so great, in order to provide a sufficiency of sheltered space, that while they will look low and depressed, they will occasion the open part or court to appear comparatively narrow and squeezed up; more especially as the same space looks considerably less when uncovered than when roofed in.

We have heard it urged as an objection to the Exchange being covered in, that it would be exceedingly difficult to light it from above without a very great sacrifice of architectural character. We, ourselves, however, are of a diametrically contrary opinion. Even supposing it to be covered by a mere skylight as a protection from the weather (as is the case with the cortile of the new structure at Liverpool, called the Brunswick Buildings) we do not see how that could interfere with the architectural elevations of the sides. We do not say it would be an improvement in point of appearance, but it would not be any great drawback on it. Hardly, however, should we recommend a skylight of that homely description for such a place as the Exchange; and skylights admit of being put into such a great variety of form, whether introduced so as to appear mere cofferings or panels receding little within the general surface of the ceiling; or as lanterns,—which may be ceiled above, and open only on their sides; and further admit of such great diversity of decoration, that a roof of the kind may be accommodated to any style and any design. While it is the most original, its ceiling, with three large skylights of plate glass (each consisting of two sloping planes parallel with those of the external and internal roof), is not the least happy idea in the interior of the Walhalla, and certainly magnificent enough, it consisting almost entirely of bronze and gilding.

For these fifty years at least, not a single edifice has been erected for the purpose of an Exchange for merchants either in Europe or America, but what has been covered in and protected from the weather, and now, instead of further improvement being aimed at, we are reverting to the old inconvenient plan of a mere open court, and to what, as such, will be no better than a pent-up and dismal area, except, perhaps, during a few remarkably bright days in the course of a summer. Almost might it be imagined that the "open court" had been determined upon, by the company of umbrella-makers, and by that of "undertakers" also. The city worthies seem to have either a very singular taste for uncomfortableness, or else very singular notions of convenience. No sooner had the public began to congratulate themselves on the very great advantages attending wooden pavements, than Sir Peter Laurie set about attempting not to *put them down*, but to take them all *up* again.

The architect of the Royal Exchange has, it seems, had sufficient influence with the Committee to prevail on them to have the pediment of the portico enriched with sculpture; let him then now recommend, while it may be yet time, that the "area" should be covered in above, for then it would be protected from the atmosphere and its London smoke, as well as from the weather; and as a hall it would not only appear more spacious than as an open court, but also more lightsome and cheerful—certainly would be more cleanly, because its pavement would be always dry.

As to the difference of appearance in regard to spaciousness, there can be no doubt; for what sort of effect, we ask, as to size, would Westminster Hall make without its roof. To an open cortile, in itself, there can be no objection; but, we must contend, it is preposterous to adopt it for a purpose where something more is obviously required.

CANDIDUS'S NOTE-BOOK.
FASCICULUS XLVI.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. Since Mr. Gwilt not only entertains, but professes, so great a horror of architectural critics, anonymous writers, amateurs, and "literary idlers," as it pleases him to call them who amuse themselves with architectural studies, it is to be hoped that some of them will horrify him yet more. Myself, for one, it may be presumed, am numbered by him among the most offensive of the tribe, and reckoned an incorrigible *mauvais sujet*, and mischief-maker. Nothing, however, can be more mischievous, or more completely opposed to the interests of architecture, than the doctrine he puts forth; for the drift of it is not to encourage the study of it as an art, but actually to *deter from* it. He would confine it entirely to the profession, treating with scorn the idea that any one else can acquire a competent knowledge of it, even as a fine art, or form a correct taste. In his opinion, the less the public know, or pretend to know, of it the better; and if he means better for himself and those (if there be any) of his way of thinking, he is undoubtedly right. Hitherto it has generally been made a subject of pride and congratulation, that architecture has enlisted among its most zealous votaries, persons of refined taste and liberal education, many of whom have rendered it essential services by their pen. But Mr. Gwilt views the matter in a very different light: he is for changing it altogether, and "*heretoforward*"—to make use of his own quaint expression—the whole race of Benthams, Hopes, Dallaways, Whewells, &c., are to be looked upon as mere "literary idlers," who, furnished with no more than a few purblind ideas, and crude notions, which they have picked up by chance, pretend to instruct and inform others in matters of architecture. Yet it is to such industrious "idlers," that we are indebted for the far greater part of what is known of the history of the art; very little information of that kind has been supplied by architects themselves, and what they have written at all seldom extends further than to the mere elements and dry rules of their art; what may be termed the philosophy of it, being rarely touched upon by them.

II. Instead of taking it amiss of Gwilt that he has omitted his work in his list of architectural publications, Wightwick ought to consider himself a very lucky fellow in escaping a good dressing from him, for having recommended the study of architecture as a very delightful, and also a very suitable, one, not only for "idle" gentlemen, but *proh pudor!* for "woman kind" also. He and Gwilt are the two poles of opinion; while the latter would confine the study to those whose proper *business* it is, Wightwick would have it rendered accessible to all; the one would have it kept as a well-watched *preserve*, with a due warning of "Man-traps and spring-guns" to scare away the public—the other is for breaking down all its paling and fences, and throwing it open as a *common*, where every one may stroll, and where literary *geese* are free to pick up what they can, and to hiss, without having their necks wrung off for their presumption. It is Gwilt's opinion that the less the public meddle with architecture the better; on the other hand, Wightwick's, that the more the public understand and render themselves competent judges of it, the better both for them and for the art itself, and those who practise it. Nor is it altogether unreasonable to suppose that people would take more interest in what they understood, than in what they are now ignorant of; and further, that the greater and more extended the interest taken in it by the public, all the better would it be for those whose interest

of another kind it is, that, instead of a mere swinish multitude, they should have an intelligent public to deal with. As far as there is cause for complaint in that respect at all, it is not that there are so *many* "amateurs" and persons without the pale of the profession who study, or pretend to study, architecture, but that there are so *few*. Infinitely better would it be if the whole public, that is all persons of education were in a manner amateurs.

III. At last Boz has introduced a new character—one which has hitherto not been handled by either dramatist or novelist—in the person of Mr. Pecksniff, the architect. All other professions—the medical and the legal more especially, have been represented and shown up so frequently, that characters of that class are almost worn out. The wonder, therefore, is that no one should have before thought of turning to the architectural one. Whether, in entering upon this fresh track, Mr. Dickens has provided himself with a *carte du pays*, remains to be seen, for all that can be understood at present is, that Pecksniff is to be a very prominent character in the work; but it is not quite so clear if he is intended to be the representative of a class in the profession, or merely an individual who might equally well have been represented as belonging to any other. If, as he very well may do, Boz should show up the peculiar kind of charlatanry which stamps the architectural quack, and distinguishes him from all others of th duck-like genus—should he expose the arts by which men totally destitute of artistical talent and feeling for *art*, obtain credit with the public for being artists—should he disclose some of the clever tricks practised at competitions by very "respectable" people—should he indulge in some pleasant hits at the *vox et preterea nihil* pedants, wh can merely talk by book and by rote, without an idea of their own—should he, among other things, exhibit Pecksniff as an architectural lecturer, gammoning his bewildered audiences with mere rhodomontade and fiction,—should he do this, Dickens will deserve our thanks, and the gratitude of the honest part of the profession. Still we have our misgivings, and suspect that Pecksniff will turn out rather an overdrawn and ill-drawn caricature, than an ably delineated character, and portraiture from real life. Of extravagant and tedious caricature there is certainly not a little, in the manner in which Pecksniff is first presented to us—blown down by the wind at his own door. Had any one else given us such a tirade of laboured nothingness, and dull attempt at grotesque pleasantry, it would at once have been pronounced intolerably childish stuff; whereas, now the critics will perhaps discover it to be very fine—one, indeed, has done so already.

IV. I entertain about the same affection for law books that Gwilt does for German architecture and German architects. Why does not a second Omar come to purge the world of them? Even a book bound in "law fashion" has to me a very odious look; it seems to have put on the uniform of that Tartuffe race of wolves in sheep's clothing, or at any rate wolves dressed up in calf's skin. Nevertheless, I have done that which a month ago I should have said was impossible; yes, I have actually been seduced into reading an article in the Law Magazine, one, certainly, that I should never have thought of looking for there, consequently might never have known of at all, had it not been put into my hands by a friend, when, to my utter astonishment, I found it contained a paper headed "*Architectural Novelties*"! It was like having a sovereign *palmed upon* one between a couple of halfpence; almost was it like my first meeting with Young's descriptions of magnificent country seats, sparkling like bright and verdant oases over the arid waste of such dreary matter as crops, and hoeing and drilling. Most truly does the poet say:

> "Full many a gem of purest ray serene,
> The dark unfathomed caves of ocean bear."

yet I doubt if the dark unfathomed caves, or bottomless pit of the law, contain anything more relating to architecture, whether in the shape of "novelties" or antiquities. There can, however, be no doubt, that a vast number of papers, of one kind or another, relating to architecture lie buried in literary journals and periodicals, foreign ones more especially. Were the best, or even some of the most interesting of them, collected and reprinted, they would form a *Reading* Architectural Library of considerable extent. It is by poking about in periodicals that we stumble upon such treasures as Edward Collow's descriptions of, and remarks on, many of the recent public buildings of Paris—things, therefore not likely to be met with by gentlemen like Gwilt, who despises periodical literature, and, though he has not ventured to say so, no doubt abhors architectural periodicals most of all. Neither are they likely to come to the notice of those who pore over the writings of the "venerable" Vitruvius, and carefully collate all the readings of different authors, in hopes of being able to catch a glimpse of the meaning of the mysterious "*Scamilli impares*." But the Law Magazine!—be it known, then, to all whom it may concern, that its article on "Architectural Novelties" gives some account of the Hall and Library about to be erected by Mr. Hardwick, in the gardens at Lincoln's Inn, at the south-west corner or south end of the terrace. The building is to be of red brick, and in the style of the older parts of Hampton Court. The Hall or Dining Room will be 120 × 45 and 54 feet high, and the Library 80 × 40 and 48 feet high; and both will have timber roofs. The remainder and longer part of the article relates to the restorations and embellishments of the Temple Church.

V. Raczynski is pleased to speak in exceedingly complimentary terms of the architecture of Edinburgh, and its recent buildings, as being in better taste than those of London; but then it is only in such safe general terms, that what he says amounts to nothing—at least to nothing more than a bare opinion to that effect, for he does not even mention a single one of the structures he pretends to admire. If the Nelson Monument was one of them, his praise is not greatly to be coveted. Speaking of that "monstrosity," the writer of the "Remarks on the Edinburgh Parthenon," tells us that "it ought to be pulled down"; nor is the same unlikely to be said of the other "Nelson Monument" in Trafalgar Square.

VI. It is provoking to find that the stupid Germans now propose to erect a public monument to Schinkel, just after Gwilt has put an extinguisher upon him. A public monument to a fellow who was no more than a mere "scene painter" in architecture! to one who was little better than an audacious heretic in the art, an insolent reformer, setting at defiance both Pope Vitruvius and Pope Palladio, and did not even abide by the authority of the Greeks themselves, but would fain be "*tampering*" with the ancient orders, like a conceited coxcomb as he was, in the hope of improving them, or at least of producing something as good, and not quite so hackneyed. A monument to Schinkel, indeed! Zounds! we will be revenged on those scurvy Germans, for we will erect a public monument to Gwilt; therefore the sooner he gives us the opportunity of doing so, the better.

PONT DU CARROUSEL, PARIS.

In the *Journal* of August, 1842, I stated that an improvement worthy of notice had been introduced in the construction of the Pont du Carrousel, at Paris, consisting in the application of wrought iron keys, so disposed as to obtain great precision in setting the segments of the tubular voussoirs, of which the arches of this bridge are composed. My intention is to explain more particularly in this paper, how far the application of these keys materially facilitated the casting of the voussoirs separately, and to show their useful effect in the construction of the arc on the piers.

The amount of contraction of cast iron, in the act of cooling in the mould in which it has been run, is variable; for although, as stated, the general average may be considered to be about $\frac{1}{100}$, this measure cannot be taken as an absolute quantity: it may be sensibly modified, by many circumstances, such as the quality of the metal, its temperature when run into the mould, and the greater or less rapidity of the cooling process. This difference is not of material importance in hort pieces, but in a length of upwards of 160 feet, it may amount to some inches, and when the pieces are cast in great lengths, (or even f they are in short lengths,) and the joints are intended to bed fairly against each other, as is the case in bridges of the ordinary con-

struction, this difference becomes a source of considerable trouble and annoyance.

It is objectionable to have to add to the length of pieces when cast, and to avoid this, the patterns are usually made full long, thereby allowing for the greatest possible contraction of the metal; so that generally speaking, a certain portion of each casting has to be removed by the chisel or otherwise, to get the pieces to their proper length. Notwithstanding these precautions, there will be occasional wasters, which may be properly or improperly patched up, or which if thrown away, give rise to extra expense and delay.

When the constructor has plenty of time at his disposal, he proceeds with still further caution, by casting the principal pieces, and having them put together; after this, the pattern of the remaining length is corrected, and sent to the foundry with the certitude, that the casting will come in pretty well; thus, by dint of precaution, delay, and expense, the work is got through to this stage, and if the mason work is prepared with the same care and precision, all will be found to come in very well; but a stone pier has been known to be a little out of its proper position, either in consequence of an error or the settling of the work upon its foundation. When this takes place, it becomes requisite to set the cast iron into the stone work on one side of the pier, and to place a thickness of metal between the pier and the cast iron on its other side. All these imperfections are only felt during the construction, they do not at all diminish the strength or interfere with the durability of the work, but generally speaking, all those who have been engaged in cast iron bridge building, will have had to exercise their ingenuity, not only to correct such evils, but at the same time to proceed in such a manner, that they may not leave an indelible trace on the face of the work. There is, therefore, no doubt but that the facility of extending, or diminishing, the chord line or the versed sine of the arch, would on many occasions be of considerable advantage.

The keys placed at each end of the segments, of the tubular voussoir, remove all the above mentioned objections, for the segments being kept rather short, the space will have to be divided amongst some 10 or 12 joints, so that three or four inches, more or less, in the total length of the arch, will only require the wrought iron keys to be made a little thicker or thinner than they were originally intended to be, and as they are not made until after the arc has been placed, no extra expense will be incurred, or time lost.

The division of the arc into so many pieces, offers another advantage, as, by reducing the weight of each separate piece, the whole can be moved about, and managed with great facility, and without requiring such powerful tackle, or such strong centering, as is generally employed. When the number of segments comprised in an arc are in their place, a wood model is made for each key, and the keys are forged and fitted in their places, without being immediately driven home; plumb bobs being suspended from the joint of the tubular rib, it becomes very easy to set the whole in a perfect line, by driving the keys on either side as may be required; and by making the keys sufficiently long, the height of the arc can be regulated with the utmost facility and precision. The keys being driven, and the whole of the tubular arc in its proper place, the bolt holes, those of one flanch having been cast in, are drilled in the opposite one, and the bolts placed and tightly screwed up, attention being paid at the same time to the plumb bobs, as the effect of screwing up the nuts may be to cause a deviation in the line of the arc, which is again easily rectified by means of the keys, and the bolts cannot otherwise affect the form of the arc.

Openings were reserved from distance to distance along the upper joint of the voussoir, for the purpose of introducing melted bitumen, which, when the bridge was finished, was done, in order to fill up the space remaining between the lamellated wooden rib, and its cast iron covering. This bitumen being intended, by setting when cool, to form a compact mass of the whole arc, with a view to increase its rigidity.

The wooden arc, as I have already said, greatly facilitated the erection of the tubular voussoir, and when standing alone, previous to the application of the latter, it has a wonderfully light and elegant appearance: but it becomes a question whether, in reality, it is at all requisite to the solidity of this kind of bridge, its flexibility being so great that it cannot in any way be expected to come to the assistance of the cast iron, which, if accidentally forced out of its original position, by any extraordinary lateral strain (the only one that could affect it) would break long before the internal wooden rib could offer any useful resistance to the strain. It also remains to be ascertained whether the wood thus confined in the tubular voussoir, will not be very subject to decay, notwithstanding every precaution that has been taken to preserve it.

The annular system of spandrils, adopted by M. Polonceau, forms another remarkable feature in this construction; they combine strength with lightness, and give an elegant appearance to the bridge. Their circular form renders them elastic; they spring under the load, so that the vibratory action, communicated to the roadway, and the upper side of the annular support, is neutralized ere it can arrive at the main rib, which, therefore, as I have already observed, maintains the most rigid firmness, under the heaviest load.

At the same time that the vibratory action is destroyed, they present also the advantage of distributing the load acting at a particular point on the road, over a considerable length of the main rib of the arch, as will be shown by the diagram.

Let us suppose three rings a, b, c, placed between a beam d, and an upper platform; and that a weight W be placed on the platform immediately over the ring b; under such circumstances the vertical diameter of the ring b, will be shortened, and its horizontal diameter will be lengthened in the same ratio; half the increased length of the horizontal diameter of b, will be taken from each of the horizontal diameters of a and c, and added to their vertical diameters, thus raising the platform immediately over the centres a and c, and by increasing its resistance, will remove a portion of the load W from the point b, to the centres a and c, thereby distributing it along the beam d.

As a proof of the advantage of this mode of construction in point of economy, it will be sufficient to mention, that although the length of this bridge between the buttresses, is nearly 500 feet, it was completed for £10,000, including every expenditure; and that, in a country where metal is very high priced. I can conscientiously affirm, that every precaution was taken, and every outlay made, that could be required to obtain good workmanship, and a solid construction. The whole of the tubular ribs were moulded in dry sand, and cast in second fusion, and the wrought iron employed is of the very best quality for the purpose.

When the bridge was finished, it became necessary, according to the government regulation, to test its strength by distributing a given load over the entire surface of the road way, the government officers in the meanwhile, minutely inspecting the work, to ascertain whether, under the strain, any defect would become apparent. This, in France, is an invariable rule adopted as a legislative measure of public security; and, until you can present a favourable report from these officers, it is impossible to obtain permission to open the bridge. We commenced by making an observation in the morning early, to determine the positive height of each arch, previous to any load having been placed on the bridge. The load (about 400 lbs. avoirdupois upon every square yard of surface) was then laid on, and in the afternoon we found that, under the load, each arch stood higher than it did in the morning without the load.

The morning (October) had been very cool, the sun coming out later in the day heated the metal, and increased its length, so that the

whole difference in the height was occasioned by expansion; it became, however, requisite to ascertain if such was positively the case, and by leaving the load on the bridge, and taking an observation again when the metal was cool, we found that the arches had returned to their original position. There is nothing surprising in this circumstance, although without reflection it would appear rather paradoxical, and I mention it, not with a view of exemplifying the effect of expansion, which is of course understood, but because I consider the peculiar system on which this bridge is constructed, to be favourable to the free action of expansion and contraction, without thereby being subjected to any strain at all detrimental to its general strength.

The part of the bridge, most immediately exposed to the action of heat and cold, and more particularly to the action of the sun, is the arc itself, the upper part of the spandrils being protected by the projection of the platform, consequently large castings would be subject to unequal contraction and expansion and consequent strain, which must very much weaken them, whereas, in bridges constructed upon this principle, the flexibility of the whole system is so great, that the expansion of the tubular rib, by increasing the versed sine of the arc, can lift the entire arch without subjecting any part of it to such a resistance as would tend to diminish its strength.

H. H. EDWARDS.

London, Feb. 20, 1843.

VARIABLE ORIFICE OF THE BLAST PIPE OF LOCOMOTIVE ENGINES.

IN the February number of the *Journal*, I described a "*Self-acting Expansion Slide Valve*," and in the course of the explanation, referred to having obtained patents abroad for an apparatus, by means of which, the orifice of the blast pipe of locomotives, can be regulated by the engine driver; I will endeavour in this paper to describe the apparatus, and to point out its general utility.

The determination of the area of the orifice of the blast pipe, is of importance in the construction of locomotives; upon its proportion depends the supply of a sufficient quantity of steam for the service of the engine, and also its comparative effective pressure upon the piston. It may be made so large, or so small, as to prevent the engine from performing her allotted amount of duty; and the application of this blast of steam, may be considered (next only to the boiler itself), the most useful invention in this beautiful machine, so essential a complement thereto, that the locomotive engine would have been very imperfect without it. The possibility of its successful application having been ascertained, experience promptly indicated the extreme limits of the area of the blast, within which the engine could exert her power; but it still remains to be decided as an invariable rule, what the exact size should be within these limits, to produce the most useful effect; and you will very seldom find any two engineers who adopt the same sized blast, for engines of the same power.

When the diameter of the orifice of the blast pipe is too great, the energy of the blast will decrease, and the draught through the fire will not suffice to generate the quantity of steam required to keep up the speed of the engine; when, on the contrary, the diameter is too small, the resistance behind the piston will become so great, in consequence of the steam not being able to escape through the contracted passage, as sensibly to reduce its effective power on the piston. Within these two extreme limits (if an invariable orifice of blast is adopted) it at first sight appears, that there must be an intermediate point at which, if it could be attained, an engine would perform the greatest quantity of work, with the smallest quantity of fuel. This intermediate point, if it can be admitted to exist, is exceedingly difficult to discover, because a locomotive engine has to overcome a degree of resistance that is constantly changing, either on account of the load, the action of the wind, the state of the rails, or other causes.

In the preceding paragraph, speaking of the extreme limits of the size of blast, within which an engine may work equally well, some doubt is expressed as to whether there exists an intermediate point that might be preferable, as enabling the engine to perform more effective duty. It is probable that within a certain limit, the blast (if invariable) may be made of any intermediate size, without sensibly influencing the average effect produced, the inconvenience and advantage resulting from the change being so nicely balanced, that no sensible difference could be discovered. If such is allowed to be the case, the efficacy of the variable blast must be manifest without a trial.

In order to diminish the resistance behind the piston at the return of the stroke, the elasticity of the steam has been taken advantage of; a chamber placed at the foot of the blast pipe, by allowing the steam to expand on its escape from the cylinder, relieves the engine, and has permitted the adoption of the most contracted orifice of blast, that I have yet seen successfully employed. The greatest relief, however, has been obtained by throwing off the steam considerably before the piston arrives at the end of the stroke, thereby enabling it to expand before the return of the piston, and thus very effectually diminishing its resistance: and although by so doing a portion of the effective power of the steam is lost, it is at the same time a judicious choice between two evils, and if not adopted, the discharge of the steam from the cylinder at the moment of the return of the piston would determine a powerful resistance to its free action, and so reduce the effective power of the engine.

The contraction of the blast pipe being an inconvenience inseparable from the condition of generating a good supply of steam in the locomotive boiler, it becomes important to partially remove this inconvenience when practicable; and as the state of the fire, and the quantity of steam required, are frequently varying, it may be positively assumed that an invariable contraction of the blast pipe is an imperfection, and that even supposing the question as to the best possible dimension were decided, and a generally admitted rule laid down, it would only then be really perfect for some particular load, and state of the fire; and that with a different load, or state of the fire, the determined orifice of the blast would be objectionable; therefore, it may be concluded that the faculty of regulating the contraction of the blast, so as to have full power over the production of steam, must be in itself a desirable condition, and that if by the same means, the average resistance behind the piston can be diminished, the "ensemble" may be admitted to be a material improvement.

It frequently occurs that there is either too much, or not enough steam in the boiler; when there is too much, it is the usual custom to open partially, and sometimes entirely, the fire door, so that by admitting a current of cold air into the fire box, and through the tubes the production of steam will be diminished; but this remedy is very objectionable, and should be applied as seldom as possible, because the rush of cold air may give rise immediately, or subsequently, to leakage in the hoops, and must very much contribute to the destruction of the tubes, and to injure the boiler itself; whereas, if it were possible to enlarge the orifice of the blast pipe on such occasions, the fire would be damped, and the steam would fall, probably without having to open the fire door at all.

When there is not enough steam, the draught through the fire, in consequence of the low pressure of the steam, and the slow motion of the engine, will necessarily be less energetic than it ought to be, the means of exciting the fire becoming inefficient at the time when its assistance is most wanted. A good engineer will certainly take care that this occurs as seldom as possible, but there are accidental causes over which he has not sufficient controul, and on such occasions the power of contracting the orifice of the blast pipe would be very beneficial, by enabling him materially to increase the rapidity with which the fire would be brought up to its proper state.

When a heavy train is going up a steep incline, its speed will decrease; the strokes of the engine being less frequent, the draught through the fire will also diminish in intensity, and the quantity of steam generated may no longer be sufficient; a slight contraction of the orifice of the blast pipe would then increase the power of the

blast, the action of the fire, the production of steam, and the speed of the engine.

The engine driver generally manages his engine and fire, in such a manner, as to obtain a full supply of steam previous to his arrival at the foot of the incline; with the assistance of the variable blast, he would naturally (having plenty of steam) enlarge the orifice of the blast pipe, and thus by diminishing the resistance behind the piston, would increase the power of the engine, so that although going up the incline, she might still maintain sufficient speed to keep up the steam, notwithstanding the enlarged orifice of the blast pipe.

When running down an incline, the orifice of the blast pipe being opened to its greatest extent, the draught will be considerably diminished, because at the same time the regulator will be partially shut; the steam may in this way be very effectually kept down, although the incline may be many miles in length: and by contracting the orifice towards the approach of the foot of the incline, steam may be again obtained, without having had to expend steam from the boiler, to increase the draught through the fire, thus effecting an economy in the consumption of fuel.

By good management, the engineer can therefore have full power over the production of steam, so as at all times to have a good supply, and to prevent almost entirely the loss occasioned by its escape from the safety valves while the engine is in motion; and taking into consideration the frequent occasions on which advantage may be derived by varying the orifice of the blast pipe, it may be inferred that it is as requisite to have full command of this orifice, as it is, to be able to determine the position of the regulator. The speed of the engine may, moreover, be occasionally regulated with advantage, by varying the orifice of the blast pipe, without altering the position of the steam regulator.

To carry out, in a practical manner, the variable contraction of this orifice, it is requisite

That the apparatus should be easily constructed and applied, and not liable to get out of order;

That its action should be simple and effective;

That an indicator should show the area of the orifice under which the engine is working.

Having pointed out the general advantages I propose to derive from the application of a variable blast, I will now describe the apparatus that has been employed, which will be clearly understood, with the assistance of the annexed figures.

In the construction of this variable blast, there is one point on which it is proper here to make a remark, which if not attended to, would materially tend to destroy the good effect to be produced.

The annular space between the internal cone and the orifice of the blast pipe, if too much contracted, diminishes the energy of the blast; so that it is necessary that, at the point of greatest contraction, with a view to obtain the strongest draught, the relative diameter should be so calculated as to leave nearly a half of an inch of space, for the passage of the steam between the internal moveable cone and the edge of the blast pipe.

The intensity of the draught through the fire can be weakened, therefore, either by enlarging or by contracting the orifice of the blast pipe, beyond a certain limit. I have occasionally regulated the motion of an engine by the contraction of the blast pipe, leaving at the same time the regulator wide open, because by contracting the orifice more or less, the pressure behind the piston may be varied, and so regulated as to augment or diminish the effective action of the steam on the piston. The adoption of this variable blast may also be considered as an extra security, for by keeping the internal regulating cone of the blast pipe closed, while an engine is required to remain stationary, no danger could arise from the accidental opening of the regulator.

EXPLANATION OF THE FIGURES.

Fig. 1. Longitudinal elevation of a Locomotive Boiler, part of the smoke box being removed to show the extremity of the blast pipe. The circular portion of the boiler between A and L is omitted.

Fig. 1.

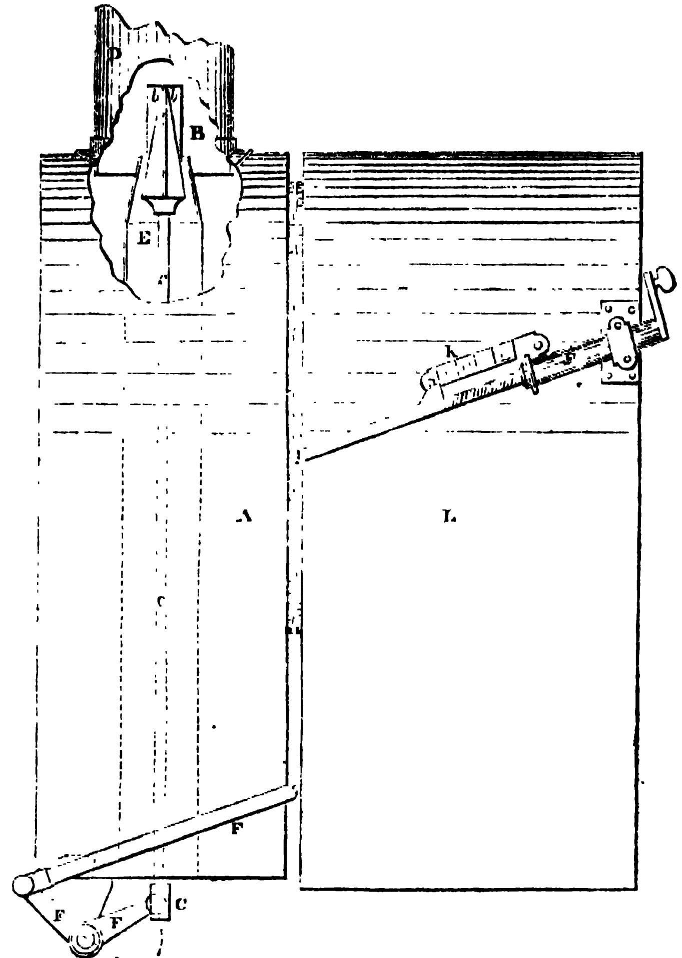
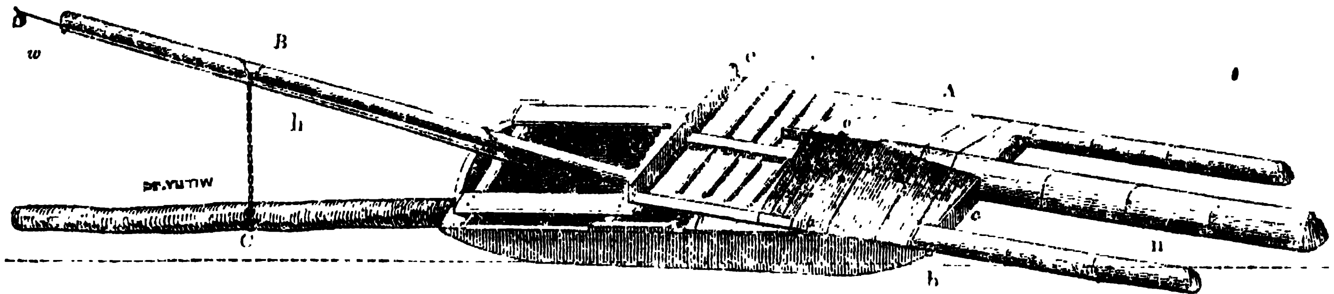


Fig. 2. Plan of the orifice of the blast pipe, showing the regulating internal cone B, with its three guide ribs *b, b, b,* upon an enlarged scale; A, smoke box; B, regulating cone of the variable blast; *b, b, b,* three thin ribs or feathers, attached to the regulating cone B, for the purpose of keeping the cone B exactly in the centre of the blast pipe; C, vertical rod, to which is attached the regulating cone; D, part of the chimney; E, blast pipe; F, hand gear to work the cone B; K, graduated plate fixed to the fire box, to show the position of the cone B, and the exact area of the orifice of the blast pipe; L, fire box.

London, Feb. 11th, 1843. H. H. EDWARDS.

THE TOMB OF NAPOLEON.—The following details are given by one of the journals respecting the tomb in honour of Napoleon at the Invalides:—In the lower part of the equestrian statue of the Emperor, which is to be erected in the court-yard, a door will be opened to a long gallery leading under the dome of the building. This gallery, paved with marble in all its length, is to be divided into three sections—in the first of which will be placed bronze alto-relievos, representing the military deeds of the republic of the emperor. The second, which exists already, and is consecrated to the interment of the governors of the Invalides, is to be enlarged, and the tombs at each side will be fenced off with bronze railing. The third section will be also adorned with alto-relievos in bronze, recording the most notable acts of the empire not military. Under the dome will be placed the tomb of the Emperor made of Corsican granite. On it will be engraved, in letters of gold, the single word—NAPOLEON.

BALLARD'S ICE BOAT.



The above engraving is an isometrical view, drawn to a scale of eight feet to the inch, of the ice boat, for which Mr. S. Ballard, had the honour of receiving of the Institution of Civil Engineers a *Telford* medal.

This boat was first used in the year 1837, on the Hereford and Gloucester Canal, and has been in operation, whenever required, ever since. It breaks the ice by *ploughing* or *forcing it upwards*, and does not require more than one-fourth of the power necessary to break the ice on the old plan of forcing it downwards against the water.

The ice-breaking frame A consists of three pieces of timber marked *n*, fastened together by two cross pieces *c* and *c*. That part of the frame which lies over the boat is boarded or planked over; one part so as to form a platform for men to stand upon, the other part raised in the middle and cased with sheet iron, that the ice may not lodge on it. The frame lies on the front of the boat, which is sloped down as shown at *a b*. The frame is made with deal timber; the two outside pieces each 27 ft. 6 inches long by 9 in. by 8½ in. the middle timber 31 ft. long by 12 in. by 7 in. These timbers are rounded on the top as far as they project over the front of the boat, and the under sides are made narrower than the top sides.

The boat is decked over from *a* to *b*, and when the ice is very strong, she has a temporary boarding over, of inch board, as far as the centre. The spar B, which projects over the stern of the boat, has the large end chained down to the middle of the boat.

The piece of timber C is attached to the spar B by a chain. It is about one ton in weight, and prevents the boat rising behind when the ice presses upon the frame on the front of the boat. It floats on the water and the chain is strained in proportion to the thickness of the ice. The timber is also chained to the stem of the boat. By these means the slope or inclination of the ice-breaking frame is kept always the same, with the advantage of a short boat, which is easily steered and managed.

The pole or shaft *h* is for the purpose of steering the boat. It is attached to the end of the spar by a chain, and is balanced by a weight *w*, so that its weight may be trifling in the hands of the steerer who walks on the towing-path.

The boat, and also the upper sides of the ice-breaking frame are cased with sheet iron. The hauling line is attached to the chain *o*.

When the ice-breaking apparatus is not required, it may be taken off, and the boat used for other purposes.

THE GREAT BRITAIN STEAM SHIP.

It was but lately that our attention was drawn to an article, published in the *Nautical Magazine* for January last, written by Mr. J. S. Enys, entitled "Remarks on Nominal Horse-power," and which is evidently a critique on an article of ours published in the *Journal*, Vol. V. p. 357, on "The Great Britain Steam Ship," the same having been copied into the *Nautical Magazine* of last November.

The object of Mr. Enys's paper is to shew the fallacy of calculations made on nominal horse-power, in fact power calculated by the rules of the late Mr. Watt, in as much as modern practice has deviated from our great master in the amount of boiler pressures, from 2½ and 3 lb., to 5, 6, 7, 8, and sometimes 10 lb. per square inch, and then proceeds to prove that the consumption of fuel by the Great Britain will be just one-half or one-third (according to the expansion) of that computed by ourselves.—He states much that is true, and something that is erroneous, and we consider, that he is guilty of omission; inasmuch, that he does not follow out his argument (he is undoubtedly able) and demonstrate what diminution of speed would result on the employment of expansion, especially to so great an extent as *one-half* and two-thirds of the stroke.

We must do ourselves the justice to say, and we are sure our readers will agree with us, that our observations were temperate, written, not in a feeling of opposition, but merely to elucidate and draw attention to what we considered errors in practice. How far we are correct in our views with reference to the case of the *Great Britain* (late *Mammoth*) time and experience only will show, we are fully content to abide by the issue.

It will be seen on reference, that we expressly guarded ourselves against any misunderstanding with respect to the character of our data, and took the trouble to explain that we were indebted for them to Mr. Hill, a writer in the 926th Number of the *Mechanics' Magazine*, so that our deductions are dependent on the accuracy of the matter there given. It does not, however, appear that Mr. Enys disputes any portion excepting the correct delineation of the boiler details, so that we were right in taking the cylinder at 83 inches diameter, 6 feet stroke, and 19 strokes per minute. In our article we entered into a calculation, founded on the capacity of the cylinders and length of stroke (commonly called *nominal* horse-power, the only data at that time at our disposal), to prove that the consumption of coals, would, during a passage from Bristol to New York, be much greater than is supposed, or than they have allowed space for in the vessel. We are met by the scientific calculations of Mr. Enys, proving that by *expansion* to one half, or two-thirds of the stroke, the consumption of coal would be considerably reduced, in a much larger ratio than the power. It is, however, worthy of remark, that, although ourselves and Mr. Enys take different methods of computing power, that we agree in the amount of fuel which would be expended, supposing the engines to work to their full power, namely 129 to 130 tons per diem.

We have again carefully looked through Mr. Hill's paper, which confirms our impression that he did not state any *distinct rate of expansion* at which the engines were to be worked, he explains the construction of the expansion valves, which are not new; and as most modern engines of large powers are fitted with similar contrivances, we concluded that in this, as in other cases, the evaporative power of the boilers and strength of the materials were calculated to supply steam for, and to resist the action of, the full powers of the cylinders, expanding the steam only by the common sliding valve, *though refinements of the special expanding valves being inserted as in other ships, for the occurrence of fine weather and fair winds.*

Our justification on this head will be complete, when we state, that "The Great Western," Cunard's vessels, the "British Queen" and "President," were each fitted with separate expanding apparatus, but that their boilers are capable of generating a full supply of steam for an expansion of not more than $\frac{1}{4}$th of the stroke—that is by the sliding valve, and it would be a matter of curious enquiry to see how frequently this is departed from. If our views be correct on this point, the general object of commanders of steam vessels, is to make

the best of their way to their port without reference to the saving of fuel, *time*, in fact, being frequently of much greater value than a few tons of coals. We state this as a practical fact, for the saving of fuel by the expansion of steam is now well known to those who have devoted the slightest attention to the subject.

Nominal horse power is certainly but a conventional expression, designed by the late Mr. Watt, as an approximative measure of the commercial value of his engines, it was very applicable to the circumstances of his times, and perhaps, *until something better is produced*, as much so to ours. It is not, as it has been called, "empirical," because it is founded on rational grounds, *and if we could get all engineers to agree to one standard of computation*, it is doubtful if any better system could be introduced—it is a mechanical test from which no engineer can escape, and we are enabled, with the aid of the indicator, to apportion to its work just as much merit as it possesses: by its use we immediately discover the principles on which the engine is constructed, the rate of expansion, the state of the vacuum, the proportions and setting of the sliding valves, and other detail absolutely necessary to the good performance of an engine—in fact, we can distinguish between a good and a bad engine, between science and pretension—and in conjunction with data relative to the consumption of fuel can precisely compute the value of each man's work.

We say it will be difficult to produce anything better than this. The commercial world is satisfied, because they may be supposed to know more of a two foot rule, and its applicability to measure the diameter and length of a cylinder, than they can possibly be of the ratio, or of the rarefaction of water when converted into steam, or of the more intricate theory of expansion. No, the commercial man will continue to buy his steam engines by the capacity of their cylinders, and with the aid of his coal merchant's account, *and the amount of work done*, will come to a pretty fair conclusion, as to which engineer is most deserving of his confidence.

These observations have particular reference to marine engines, in which it is well known that *space occupied* and *weight* is of paramount importance, and it has been the aim of much consideration and reflection to obtain these, with the exertion of the greatest power at a minimum expence. We call this the *ne plus ultra* of marine engineering.

We may, therefore, doubt the judgement of the engineers of the *Great Britain*, who are using cylinders equal to 1200 horses, and by expansion, reducing the same to 700 horses, occupying both the weight and space of the former power; but perhaps we are again in fault, new reasoning on the *assumption* of Mr. Enys, as in the former paper on that of Mr. Hill.

Mr. Enys observes, "that nominal horse power is a most inaccurate basis for calculations of this nature," that is, the consumption of coal and speed of the *Great Britain*.

With reference to the first proposition, the consumption of fuel, we most freely assent. The value and the theory of expansion has been so fully explained by many writers, perhaps especially so by Farey, that it is beyond dispute—it is no new light which has burst upon us. A few years since, some attention was drawn to the published logs of certain steamers, in which assertions were made, that the consumption per horse was (as now reproduced by Mr. Enys,) as low as 6½ lb. nominal H. P. per hour, and which was satisfactorily shewn to have been produced by expansion, during fine weather and favourable winds; but that, when the full power was exerted, the consumption of fuel reached from nine to 10 lb., the general result of the best machinery, so will it be with the *Great Britain*. If, as we had supposed, from the lucubrations of Mr. Hill, that her engines are designed, *when necessary*, to work to their full power, and by *full* power we mean expansion by the sliding valve alone, and exciting an average pressure on the piston of at least 14 lb. per square inch, exclusive of the friction, then will our computation of consumption at 10 lb. per horse be found correct: that is, supposing the engines and boilers, scientifically and practically constructed; but if any credit is to be attached to the delineations of Mr. Hill, we must be allowed to doubt if even this point of economy will be attained.

If it be intended to work these engines at a *permanent rate of expansion beyond that of the ordinary sliding valve*, a corresponding saving will accrue in the exact proportion of the length of the stroke worked by the dense steam; or, in other words, the quantity of steam used or admitted into the cylinder, before the communication with the boiler is cut off. If the stroke be six feet, and the steam shut off at three feet, the consumption of fuel will be reduced ½ (we speak practically), if at ⅔ of the stroke, it will be ⅓, and so on. The reduction of the power will be in a much less ratio; and from all we have gathered from a considerable experience, the velocities of the ship will be, as the cube roots of the reduced powers. These, then, are the advantages of expansion.

In order to bring this question more fully before our readers, we have made the following calculation relative to the engines and boilers of the *Great Britain*, and which will at a glance show what will be the consumption of fuel per horse per hour—the power exerted—the cubic feet of steam per horse per minute—the cubic feet of water to be evaporated per horse per hour—and, though last the most important, what we conceive will be the velocity of the ship, with full steam pressure, and with expansion from ⅙ to ¾ of the stroke, giving the results for every *six inches*—from 12 inches to 54 inches, or ¾ of the stroke.

Eng[illegible] inch [illegible]nder; 6.0 stroke; 228 feet per minute; 294 horse power each.

Expansion in inches of the stroke	12	18	21	30	36	42	18	54
Horse Power with dense steam . ..	215	220·5	196·0	171·44	147·	122·	98·0	73·5
Horse Power during expansion	[illegible]·59	61·96	79·38	91·00	101·87	117·18	107·7	101·87
Total power, whole stroke	28[illegible]·59	282·46	275·38	262·44	248·87	229·68	205·7	175·37
Total power with 4 cylinders, as *Great Britain* ..	1158·3	1129·8	1101·5	1049·7	995·5	918·72	882·8	701·48
Contents of cylinder at this expansion	211·15	1[illegible]0·	167·	147·8	126·7	105·6	84·5	63·4
Cubic feet of steam 2½ lb. above the atmosphere per horse per minute	27·6	25·5	23·5	2[illegible]·5	19·5	17·5	15·8	13·7
Cubic feet of steam at the atmospheric pressure per horse per minute	32·5	30·1	27·75	25·4	23·0	20·6	18·7	16·2
Water, per horse per *hour*, to be evaporated	1·14	1·09	·98	·912	·840	·726	·66	·571
Coals per horse per hour, at 8 lb. per horse	9·0	8·51	7·71	7·12	6·55	5·87	5·15	4·5
Tons per 24 hours	111·5	103	92	80	70	58	45·5	34·
Speed of vessel with paddle wheels	13·9	13·8	13·7	13·5	13·25	12·9	12·1	11·7
Speed of vessel with screw	11·6	11·50	11·40	11·25	11·1	10·75	10·3	9·85

This table corroborates Mr. Eny's general reasoning, but we differ in detail arising from different estimations of the *full* power, and we would suggest to Mr. E., that he is obviously incorrect in assuming the "evaporation of a cubic foot of water to be equal to one-horse power," because that depends entirely on the rate of expansion used in any particular engine.

We may remark that we have constructed the foregoing table on the plan laid down by Mr Farey, the truth of which we have *practically* proved by indicator experiments—presuming that low pressure steam at 3½ to 4 lb. is to be used, we have supposed its density in the cylinder to be about 2½ lb. on the square inch, and have reduced this to atmospheric density for the calculations relating to the consumption of fuel.

We have been more liberal than Mr. Enys, and have allowed that *good boilers* can evaporate 8 lb. of salt water with 1 lb. of coal; that is, if they are kept in a fair state, by blowing off, or by the use of the

brine-pump. This is no *supposition* on our part; it is a practical fact well known to most marine engineers.

The result given by us is also a minimum, inasmuch as we have only considered the *exact* quantities of steam required, and have not made allowance either for condensation, or for the waste at top and bottom of the cylinders, preferring that our readers should estimate this according to their own views, as far as our experience goes, we believe the allowance ought to be about $\frac{1}{20}$ of the whole quantity.

But has Mr. Enys any reason to conclude that these engines are to be worked expansively (we of course assume that he is not in any way connected with the undertaking)? We think not; and that such is not the intention of the engineers. We have noticed that she is fitted with ordinary sliding valves, arranged (with a lap of 2½ inches, and stroke of 14 inches) to cut off the steam at ⅔ of the stroke, we suspect that the separate expanding apparatus is to be used in fine weather, as in most steamers of large class; and it will be observed that Mr. R. Hill expressly states that the cranks are placed in opposite directions, and not at right angles (p. 254); and, further, the construction of the boiler is proof that the engines are occasionally intended to exert their full power, say an average pressure on the piston of 14lb. per square inch.

We are inclined to be thus particular with reference to this point, because our professional knowledge has been questioned, in having made the statement that the grate surface is "less than half the proper quantity." We are, however, hardy enough to reiterate this assertion; and further to say (if any dependence is to be placed on the drawings), that a more unscientific or badly arranged boiler could not be devised. We have made a careful analysis of its properties, and it bears out our views that it is constructed (by the amount of its absorbent surface) to supply steam for the full power of the engines, at which the consumption of coals will be fully equal to our original computation, namely, 120 tons per day. It is as follows:

Fire surface of the six boilers	=	2220	square feet.
Flue surface do.	=	11870	do.
Total surface		14,090	

If the total surface be divided by the total horse power, we shall have 14090 ÷ 1176 = 12 square feet per horse, and the grate surface 2 feet × 6 × 24, = 288, ÷ 1176 = ·245 of a square foot per horse.

We have no disposition to cavil about words, but think we may call the practice of our first engineers *proper*, but certainly not *usual*, in as much that in this very case there is an exception to the rule, and a straining after novelties at the expence of that which is useful. We here find that we have more than the *proper* quantity of absorbent surface, and less than one half the grate surface, and the result will be a very indifferent ratio of evaporation, as will be discovered when it is too late.

The size of the air-pump must of course be large enough to suit the extreme power of the cylinders, and cannot be adapted to various grades of expansion. With respect to the large condensers, theory taught us the doctrine as that propounded by Mr. Enys—the larger the better; but, from actual observations and practice, we find it is not correct, and that Mr. Watt was right in constructing his condensers of the same capacity as his air-pump. The proportion of Mr. Watt for his air-pump is about a sixth of his cylinder contents; and it is reasonable and just, the steam rushing from the cylinder, is condensed in detail, and the air-pump, at *one stroke*, clears the condenser of whatever vapour may remain. In the *Great Britain* this vapour *will accumulate* in the condenser; being between 7 and 8 times larger than the pump, which has no power to clear it; the condenser becomes hot, and no extreme quantity of injection water will keep it cool. We may or may not be correct in our view of this matter, but practice supports it, as our readers will see by reference to our last December number, page 399, vol. V., in which we have detailed the proportions used by some of our most eminent engineers.

We have little more to say regarding the probable speed of the *Great Britain*. We believe the factor 1400 to be applicable, having found it correct in very large vessels; and we see nothing in the construction of the *Great Britain* to render it inapplicable; presuming that the resistance (in all cases of similar form, as it regards the sharpness of the water lines) is very nearly as the areas of the immersed midship sections; lengthened experience and experiments with a great number of vessels have proved this. In this case our data is meagre, and we have no desire to carry the subject further, especially as it is probable that an actual trial of the *Great Britain* will soon settle all the questions in dispute.

We close with the remark, that however we dissent from the views of her engineers in matters of detail, we most sincerely hope that we may be found false prophets, and that the *Great Britain* will prove to be superior, if possible, to her sister vessel the *Great Western*, and that the proprietors will have every reason to be proud of their speculation.

THEORY OF ARTESIAN WELLS.

A French pamphlet, from which the following translation is made, has excited considerable interest in France, and is, up to this time, in constant requisition by the numerous visitors to the scene of M. Mulot's labours at Grenelle. Our readers, however, will have the goodness to observe, that although we present it to their notice, partly on account of the notoriety which the author's views have obtained in France and partly because it is important to consider ingenious arguments on both sides of a question like this, at the same time we feel bound to dissent almost entirely from the author's explanation.

If the ingenious and eloquent Parisian had been favoured by previous acquaintance with the phenomena of springs as exhibited in the extensive mining operations of this country, it is probable that his surprise would not have been so mightily excited by the Artesian fountain at Grenelle, and he might possibly have entertained a different and more generally received opinion as to its origin.

Ex [illegible] of the Well at the Abattoirs of Grenelle.

Chapter I.

of the Subject; false attempts at Explanation.

This work which has discovered to the city of Paris the source of an abundant supply of water, has been not more remarkable for the boldness of the conception which gave rise to it, than for the perseverance with which the design has been followed out. In the bosom of the capital M. Mulot has opened a sort of aqueous mine, rich and magnificent; and for this great boon the Parisians are unanimous in their expressions of admiration and gratitude. The sight of the ascending stream rushing upwards from so great a depth beneath the surface has daily attracted crowds of visitors. After the first gratification of their curiosity, the attention of this multitude is naturally directed to the cause of so extraordinary a phenomenon, and the desire for information on the subject corresponds with the admiration it excites. Each successive visitor asks himself, or inquires of those around him, whence *can* proceed so impetuous a stream? what force impels it? what immense reservoir feeds it? in what part of the earth is deposited this fruitful supply, and by what passages and communications does it find access to the extremity of the vertical tube which M. Mulot has forced into the bowels of the earth? The scientific men of the present generation have endeavoured to answer these questions. Referring to the very simple means which human ingenuity has long since employed for embellishing our gardens and public places with jets of water, they have said,—At a certain distance from Paris, and in the upper stratifications of a soil more elevated than Paris itself, there exist vast reservoirs fed by the infiltration of rain water and of melted snow. This water there sinks to great depths below the surface, and, flowing in subterranean sheets, the augur of the engineer discovers it at a spot far distant from where the earth first received it, and after he has thus succeeded in boring down to it, the liquid element naturally ascends to the surface through the vertical issue which he prepares for it. This is then a real *jet d'eau*. Nature has placed the first, that is, the descending branch; the engineer places the second, the ascending branch; the machine is perfect.

From this explanation, however, we entirely dissent, and fear not to affirm that under such circumstances water never could rise on the principle of a syphon. In order that a jet of water, whatever may be its dimensions, shall work with certainty, one condition is indispensably necessary, viz., the uninterrupted continuity of the curved tube charged with conducting it from the reservoir above to the less elevated region where the jet is required to play. All the *force of ascension* in the second branch of this tube ought to be derived from the accelerated velocity of the water in the first branch, and this acceleration would be as inevitably broken and annihilated by any obstacle, as by the entire destruction of the continuity. Now, in the interior of the earth, to whatever depth we may penetrate, we can find nothing resembling continuous tubes; every thing there is more or less friable, casual, and irregular. Thus, whatever pains the engineer may take in order to reach by the smaller end of his vertical tube the surface of a subterranean sheet of water, it will all be useless unless by a very astonishing fortuitous accident, he should meet with another tube of the same calibre, ascending without rupture to the upper reservoir. If, as some believe, it be in the mountains of Burgundy that this reservoir is placed, is it possible to conceive the existence of a continued oblique tube ascending from beneath Paris to the neighbourhood of these mountains? Besides, no one appears to doubt that M. Mulot's choice of a situation for his well was perfectly arbitrary, and therefore if he had attempted to construct one upon the Place des Invalides or in any other part of the capital, he would have equally succeeded. Hence, then, it will be granted that in and around Paris it would be possible to dig an indefinite number of Artesian wells, all which would be fed by the mountains of Burgundy; and in order to explain this, we must picture to ourselves the uppermost beds or strata of earth under Paris and the surrounding country within a circle of two hundred leagues diameter, invariably woven into an inextricable net-work of which each filament is an unbroken tube. Assuredly nothing like this exists.

There are others who have sought to explain the rise of water by conceiving two concave vases, or two immense cisterns of unequal diameter, placed one within the other, the basin of Paris occupying the centre. They imagine that the margins of these vases extend from the mountains of the Vosges on the east, to Havre on the west; and from the plains of Flanders on the north, to the mountains of Burgundy on the south. They suppose that between these two vases there is a space filled with sand. The rain water which penetrates into the pores and cavities of the sandy district is retained there by the dense matter of the two vases. The water maintains the same level through the whole of the sandy space, but it does not penetrate into the basin of the higher or smaller vase. Hence it follows, that by boring vertically through the basin, the water confined in the sand will instantly rise to the height of that which exists in the circular reservoir all round it. This is certainly a very amusing geological disposition of things, but unfortunately it is supported neither by facts nor reason. A continued vase with a double bottom, more than a hundred leagues in diameter, fixed in the bosom of the earth! A vase whose inferior limits, as shown at this day by the well of Grenelle, are no less than 1690 feet deep, and into which flow all the subterranean waters from all the surrounding shores! What a gigantic disposition of things, and no less gigantic than admirable! A god must he have been who founded Paris, and cradled the capital of the world in the centre of this marvellous vase! Ridiculous idea to imagine, even if this vase exist, that it should be unbroken throughout so vast an extent. Do we not know on the contrary that the vase is cut up and divided into many irregular compartments? Throughout the prodigious extent of space which is claimed for the field of this theory, as at Tours, at Elbœuf, at St. Denis, and St. Ouen, numerous Artesian wells have already been constructed, and all these wells of many various depths are much shallower than that of Grenelle. Has each well, then, its respective vase encased in the general vase, and resting upon its own particular bed of sand? If such be the fact, we must suppose that a great number of Artesian stages exist in the general vase. But in this case, why did not the water rise at Grenelle when the augur had reached one of these elevated stages, that of the St. Ouen for example, so near to Grenelle? Does not the Artesian vase of St. Ouen extend to the abattoirs of Grenelle? If not it must be singularly circumscribed. It has nevertheless supplied for fifteen years two constant fountains, and the Artesian wells of Tours, Elbœuf, and St. Denis are equally inexhaustible. Doubtless we may construct an indefinite number of Artesian wells upon the surface of the country which surrounds Paris; indeed this experiment has been made in various places, and according to a report addressed to the Academy of Sciences, dated 15th March, 1841, we find that "many of these wells bored at the bottom of a valley, yield no water, whilst others fixed upon the side of a hill, furnish an abundant flow." What inexplicable mystery in the hypothesis of a sheet of subterranean water fed by rain, and springing up only from inferior cavities to establish a horizontal equilibrium. Again, if it be said, that the general vase, the centre of which is placed beneath Paris, receives throughout the whole circle of its sandy borders the rain water from the Vosges, from Burgundy, from Bretagne, and from La Vendée, we ask how it is that all these waters, flowing over slopes of many different inclinations, but all of them more or less steep, and always repairing to the same cavities, has not long since choked up its own passage by the sands which it must have carried along with it. The great sands in the Delta of the Nile, in the Gulf of Gascony, and in the Aigues Mortes, all teach us the inevitable results of continual deposits. And if we suppose that the two cisterns here spoken of, are formed of a substance impermeable to water, such as glass, or porcelain, or baked earth, how has it happened, that buried in the earth during many ages, they have never experienced any shock or accident which would have broken them to pieces? It is evident if any thing of this latter kind had ever occurred, that the water which had lodged in the interval between the two vases, would naturally pass through the fissures and ruptures into the cavity of the upper vase, thus destroying the internal arrangement of the hydrostatic machine, whose existence has been so gratuitously assumed. Besides, if this machine really exists under the basin of which Paris occupies the centre, if it has its circumference at Havre, at La Fleche, in Burgundy, and at the foot of the Vosges Mountains, we could not construct Artesian wells at any of these points, for throughout the whole of this circumference, the aqueous reservoir would be only at its origin and would have no vase to rise into. And yet, nobody doubts that in the neighbourhood of all these boundary districts, the Artesian well has as much chance of success as at Paris, St. Denis or Elbœuf. It is also known that the Artesian wells of Tours have succeeded, although on the south side of the basin of Paris.

By the simplest laws of physics, we shall now show how imaginary is this Artesian source of water. We are told that through immense beds of sand the water sinks from the surface of the soil into the grand subterranean cavity. But who does not know that, when obliged to sift itself through a bed of sand, however loosely disposed, water loses all motion, except a kind of slow and difficult leakage. Towards the base of our artificial sandy fountains it comes only drop by drop, and it loses in its course all the velocity due to the space it has passed through, and all the pressure due to its weight. If the spout which discharges the water should open upon a bent tube with an ascending branch, the water would not rise above the level of the space which it already occupied in the base of the fountain. This would be its whole hydrostatic power; and if the ascending tube were full of sand, it would rise something above this same level: but, in that case, the effect would be due entirely to capillary action. The most striking objection, however, still remains. During the summer, what becomes of the rain water immediately after falling. The greater part, instead of sinking into these profound depths, is evaporated and carried off through the atmosphere, and it is very seldom that either our fields or gardens, the morning succeeding a storm, show any traces of moisture more than a foot in depth. Would not the alternation of wet and dry weather cause an incessant variation in the flow of an Artesian well, seeing that this incessantly varies the supplies of our fountains and the height of our rivers? Oh, no! in spite of all this, the Artesian wells have always the same volume, and in truth, acknowledge neither summer nor winter. We shall, hereafter, explain the constancy of Artesian wells. But, in the first place, we must consider another gratuitous supposition. Let us first explode all error, we shall then more easily arrive at the truth. It is said, by some, that the rain water and that which proceeds from the melting of snow, sink into a subterranean horizontal region void of solid matter, but hemmed in above and below by two beds of impermeable clay. Upon the upper one reposes an enormous mass of chalk and other calcareous stone, which bears with all its weight upon the volume of water underneath, and this weight forces the water to rise vertically at every place where an opening is made down to it from the sur-

face. In this hypothesis all the mechanism of ascension derives its impetus from this force of pressure. The origin of the water is a matter of indifference, it may have come from Langres, from the Vosges, or from the Jura mountains; its complete inertia is the same when it has arrived in the centre of the basin, beneath the abattoirs of Grenelle. The process of filtration which has brought it to this place, gives it at least no inclination to ascend it has, therefore, waited patiently to be impressed by superior masses, in the same way as the fluid, which is motionless in the body of a pump, waits only the action of the piston to force it upwards. But to produce this discharge the piston must move—it must, in reality, press upon the water which it brings or sends up—in fact, it must work up and down in the barrel of the pump, filling at each successive point of its motion the whole area of the barrel. If we suppose that the subterranean sheets of water rise only because they are pressed by the solid masses above them, we must also suppose that these masses really *act*, as no ascension can be obtained except on this condition; that they actually *fall*, so that, in digging the well of Grenelle, there finding water 1600 feet below the surface and causing it to flow impetuously more than 80 feet above the surface, M. Mulot would have expended so much art and courage only to provoke a disastrous crash in the strata beneath Paris. Evidently, however, and very happily, we may add, this has not been the result. The laws of gravity are universally the same. Place on the surface of the earth a sheet of water of any extent, fill, for example, the basin of the Champ de Mars with a body of water which shall remain there; endeavour then to gain dominion over this sheet of tranquil water through solid masses of chalk or clay. In order that these masses shall remain in position superimposed on the stagnant water, they must be fashioned into vaults and arches, and there they will be supported without pressing upon the water of the basin. If, for a single instant, they should rest upon this water, they would inevitably sink and be submerged in it, and the result would be a chaos of *debris* saturated with water. But in the bosom of the earth no solid masses are found in the shape of vaults, neither are there any sheets of water, either confined or at liberty. It is true there are here and there, in the cavities of rocks, in subterraneous grottos, and at the foot of all great mountains, a few pools of water, or more often there are rivulets fed by the infiltration of rain water, and serving to supply fountains which rise at a short distance, and which generally contribute to the formation of streams and rivers. But nearly all these are found on the surface, none of them can occupy a space of any extent in the lower beds of the earth, because they would soon fill up such spaces, by depositing the sand which they bring with them. Besides, in any case the subterranean waters impelled only by a broken, unequal, irregular movement, would have no disposition like those of a *jet d'eau* to rise above the inclined bed over which they had flowed. A *jet d'eau* in exercise is in fact a pendulum, it is free and regular in its movements, its mechanism is the same, and the same cause produces it.

Now if a pendulum, starting from any altitude whatever, should meet in the course of its descent towards the vertical line, any obstacles which retard it, the motion will either stop at this vertical line, or at least the oscillation will be very feeble, since it will correspond to that feeble force of acceleration which the obstacle may not have entirely destroyed. In the same manner, the liquid pendulum, that is, the column of water, throughout its descent to a horizontal situation, rigorously requires, in order to an equal rise in the ascending branch, that all its motion and all its acceleration should be truly effected in a continuous canal, entirely filled by the water itself, by the water alone, and that so perfectly as to be inaccessible even to atmospheric air.

We shall now describe a simple and conclusive experiment. Upon the bottom of a basin, place an upright tube with an opening entirely through it; and on some stormy day fix the basin beneath the water pipe of a house. The tube will be found to contain some water at its lower end, but only to the height of that which is also found in the basin around it. Not a single drop will rise above this level because all the force of its fall is expended on the basin itself. But let us now replace the straight tube by one which is curved upwards from its lower extremity, and we shall find that the force of the fall, being confined to the continued column of water which must entirely fill the tube, will cause the water to rise in the ascending branch to the same height as the top of the descending branch. We have now then constructed a real *jet d'eau*, because we have made use of the only apparatus which can produce one.

It is quite certain that the crust of this earth no where contains an apparatus of this kind; the flowing of an Artesian well cannot therefore be assimilated to a *jet d'eau*. Some other explanation then must be sought, and in order to be satisfactory, it must be one which answers all the conditions of the phenomena.

The explanation we are about to give is necessarily of this kind, since it is derived from an universal principle of nature.

Chapter II.

The true explanation.

The globe which we inhabit is manifestly a focus of action and heat, which has its greatest energy at the centre of the mass, and which, from this central point, works incessantly to carry matter from the interior to every point of the surface, and which, in this constant effort, meets with a gradually increasing resistance from the successive strata composing the crust of the earth.

This exterior resistance constrains the central fire to divide and attenuate the matter of the interior, and to sift it, as it were, in minute particles through the pores of the general envelope.

From this internal elaboration, and this subtile oozing out, arises the continual emission of interior caloric, an emission which necessarily takes place in a radiating form; that is to say, each jet or steam of caloric escapes and flies off in a direction perpendicular to the surface. Here then is the first analogy with the vertical stream of water which issues from an Artesian well. Each pore in the terrestial covering is an Artesian well of caloric; and so again is each pore in the surface of every star in heaven an Artesian well of light. These Artesian pores in the crust of the earth being infinitely numerous, it is through these that the central fire impels, in a state of the most minute subdivision, a great part of its interior contents.

This way of escape, however, is not every where sufficient; the central action does not appear to succeed in attenuating every substance to such a degree as to effect its expulsion through such exquisitely minute apertures. At many places under the terrestial covering, opposing masses are crowded together, some in a state of gas, others in a vapoury state, others again in a liquid form, and others possessing the consistency of solids, but at the same time broken and confusedly mixed together; and all these substances, whether gases, vapours, liquids or solids, are agitated by a movement whose impetuosity equals its disorder.

The time is now come when the exterior resistance is suddenly conquered; the crust cracks—a *volcano* is open, and its centre shoots forth immense jets, at first of gas and vapour, then of liquid water, then of burning lava. It is a frightful pit, suddenly thrown out by the irritation of the central fire.

We know that the volcanoes of Iceland frequently vomit forth torrents of gas, vapour, and liquid water, which cannot have come from the sea, as its composition is different from that of sea water.

Let us imagine, for a moment, what would happen if at the instant when a volcano was about to burst forth, its crater could be contracted into a straight tube like that of Grenelle! What a magnificent Artesian well would then be displayed! What force and height would there be in the jet sent forth!

But let us not forget that every volcano is a kind of relief and vent for the interior tumult of the earth. It resembles the pimples and boils on the skins of men and animals. In the normal or regular state, the volcano is silent, and so in a state of health is our skin smooth and sound.

Thus, at the present time, when no terrestrial volcano is in a state of formidable eruption, the globe, like a sound and healthy man, quietly and uniformly transpires through every microscopic opening in its surface, the superabundance of its interior productions; and under their general covering these productions are chemically elaborated, so that each may occupy its proper region. The water in a state of vapour, which is directly formed in the bowels of the earth, even finds a passage through strata of the denser character. If near the surface it meets with argillaceous masses, it requires an increase of effort to traverse them. Below these the vapour thickens, condenses, and takes at length the liquid form; and then, far from being op-

pressed by the contact and weight of the solid masses which cover it, the water is constantly, if we may use the expression, in a state of insurrection against them, and continually seeking to rush up through them, or throw them off.

Hence it is that if human industry, exerting itself at the surface of the earth, shall pierce this surface and force down a vertical pipe into the aqueous region, the impatient water seizes upon the means of escape, and fully liquified by its very first movement in a passage so contracted, runs impetuously through its whole length. Arrived at the orifice, it flows over, and even mounts above it. The vertical jet has a force proportionate to the depth of the excavation which was necessary to arrive at the water.

This circumstance is remarkable, for the contrary would be the case if the Artesian fountain were produced like an ordinary jet d'eau, by the simple weight of a liquid column falling from an elevated reservoir, and working to regain its level. We know that in every hydraulic apparatus, the effective action is weakened in proportion to the extent of surface which the liquid has to pass over, and to the friction it has to overcome.

But not only is the force of the Artesian jet much greater in proportion to the depth of the excavation—the heat of the liquid itself shows clearly that the augur of the well sinker has more closely approached the producing and expelling fire which exists in the centre of the globe.

The source then of Artesian eruptions, is the same as that of volcanic eruptions; it is the central action of this terrestial globe; it is the formidable Power, which, during the infancy of the world launched out upon its primitive surface alike the isolated cones and long unbroken chains of lofty mountains, and which from time to time is exerting efforts to raise new mountains. This marvellous Power is that sole and universal Force, that Expansion which is constantly in exercise throughout all material being; it is none other than the grand PRINCIPLE, the SOUL of nature, the producer of *life*, which under the eyes of all men, spreads and developes itself throughout the substance of every organized being, and whose expression and sentiment each one of us exhibits in his own person.

REVIEWS.

Walks through the Studij of the Sculptors at Rome, with a brief historical and critical sketch of Sculpture from the earliest times to the present day. BY COUNT HAWKS LE GRICE, K.S.G., Chamberlain of Honour to his Holiness the Pope, &c.

"It is with great pleasure," says the *Diario di Roma*, "that we announce this new work, by a learned Englishman; it contains descriptions of works in sculpture, executed by the most renowned living artists. And we may now congratulate ourselves in having, in this work, found a person in every respect qualified to do justice to living merit, and at the same time give a sure and instructive guide to direct attention to the modern productions of the chisel. Throughout the work, the Count displays profound erudition, and extensive knowledge of the arts, and much beauty of classical and poetic illustration. Hitherto, there existed no book to guide the inquiring traveller through these repositories of modern genius and taste; and hence numbers visited Rome, without deriving pleasure or profit from their inspection." In consequence of these remarks we were led to a perusal of the Count's work, from which it would appear that sculpture has attained, at Rome, a remarkable degree of perfection; and that many of the works of the nineteenth century are equal to those executed in the Augustan age.

The degradation of taste in the arts has ever been a mark and consequence of the degradation of taste in literature; and we shall find during the four great ages of the fine arts, that literature flourished. The first and most brilliant age was that of Phillip and Alexander the Great, or that of a Pericles, a Demosthenes, an Aristotle, a Plato, an Apelles, a Phidias, and a Praxiteles. The second age is that of Cæsar and Augustus, distinguished likewise by the names of Lucretius, Cicero, Titus Livius, Virgil, Horace, Ovid, Varro, and Vitruvius. The third age was in the time of Medicis; the most glorious age of Italy, when learning was restored under the Popes Julius II and Leo X, and when flourished a Michael Angelo, a Raphael, a Titian, a Tasso, and an Ariosto.

But it is time that the Count should speak for himself. In describing an allegorical bas-relief, the author says—

"This allegory is intended to show the difficulties which the arts have to contend with, from the ignorance or malevolence of those who can neither understand their value nor feel their influence, and whose souls are so materialised, if we may be allowed to use the expression, philologically not metaphysically, as to appreciate nothing which is not gross. For such souls, the noblest productions of the chisel and the pencil possess no attractions; the works of genius and of taste are to them as so much waste marble and canvass; and there are not wanting some, who would gladly wage a war of extermination against the productions of the chisel and the pencil. Even in Old England, my own, my native land, the land of commerce, wealth, power, freedom and science, how comparatively parsimonious is the encouragement of the fine arts, and how comparatively unknown are sound artistic principles! Far from us the ignominy of disparaging our adored country, which absence has served only to endear to us still more: but it is time that England should take her stand among the nations of civilized Europe in relation to the fine, as she does with regard to the useful, arts. It is time that a fair portion of that wealth, which is so often profusely expended on less refined enjoyments, should be appropriated to the encouragement of the liberal arts, particularly of sculpture and painting; and we should no longer bear the reproach of employing foreign artists, whilst we neglect to promote the cultivation of national artistic taste and talent."

The Count again observes—"The foreigner finds no obstruction in Rome to his progress in the fine arts; but, on the contrary, enjoys indiscriminately with the Roman, all the facilities that Rome commands. Hence, we find that Thorwaldsen and Fogelberg have abandoned the frozen regions of the north to bask in the sunshine of their fame in the more genial clime of the south. These eminent sculptors have both won laurels for their country. France, too, is not backward in the race of glory; and her splendid academy in Rome will perpetuate her series of distinguished artists. Russia, too, extends efficient patronage to her native artists; and at this moment she maintains in Rome 30 pensioned students. Naples, also, has a Royal Academy here, under the direction of Baron Camuccini, the first of living painters: and Berlin, Spain and Portugal, have also their respective academies in Rome, as have several other nations, too numerous to be mentioned. Thus does Europe testify, that Rome is in truth the only school for the fine arts. And must we make one painful exception, and that exception our own, our native land? Yes, it is our painful duty to state, and we do so, in the humble hope of drawing attention to the fact, and remedying the evil, that England, with all her wealth, sends but one solitary artist to Rome from the Royal Academy, and that once only every three years! How, then, can she compete with other countries in the true classic style of art."

In speaking of the extraordinary progress of sculpture, our author observes—"The group of Nestor and Antidochus by Alvarez, executed during Canova's life time, the Discobulos of the late Kessels, the Achilles of Albasini, and the Mercury of Thorwaldsen, astonished the whole artistic world; and yet they essentially differ in style and character from the works of the immortal Canova. These productions have aided in producing a revolution in style, which is likely to be permanent; and all with one accord now agree to follow the pure style of Grecian sculpture. Denmark has now to boast a Thorwaldsen; Sweden a Fogelberg; England a Gibson and a Hyatt; Ireland a Hogan; Scotland a Macdonald; Italy a Tenerani and a Finelli; Spain an Alvarez; and Holland a Kessals, all educated in Rome, and essentially Roman sculptors of the revised school of Grecian art."

It does appear that nation after nation and century after century have been able to do little more than copy the Grecian masters. We know the use Virgil made of Homer in his Æneid, and of Theocritus in his pastorals; and we find that Horace applied several places, out of Anacreon and other lyrics, to his own purpose: therefore, why should we preclude the modern sculptor from copying from Grecian art? "There is," says the Count, "but one school of art that can lead to perfect design and execution, and that is the school of Grecian art. Any deviation from the Grecian type must necessarily be a departure from the only true standard. The choice of a subject, the attitude, and in some instances, the drapery, are all of comparatively minor importance, provided the artist has made the severe, classic style of Grecian art his canon. The works of the greatest modern artists should not be taken as models; to copy their style would be to give a translation from that which has been already translated; and he who suffers himself to be carried away by his admiration of modern productions, should bear in mind that their authors drew their excellence from no living artist, but from the great masters of ancient Greece, whose productions they have profoundly studied. When the great Canova blazed in the zenith of his fame, many artists became imitators of his style, and their copies were mere shadows of the

great original; they wanted the soul that animated his statues: and the exquisite essences, which Canova extracted from Grecian art, had evaporated in the attempt to transfer them. That the works of any eminent modern artist may be consulted with advantage we freely admit: they serve as a guide to the ascent of an eminence difficult of access; they inspire the artist with ardour; and encourage, while they urge him onward by their counsel and example. They are so many auxiliaries to the other powerful excitements to glory; and their combined influence has fired the breast of our talented countryman, and raised him to the proud eminence from which his genius (Gibson) sheds such lustre on his name and on his country."

Our author seems to have forgotten our distinguished countryman, Mr. Baily, who, says a recent writer, "is one of those instances, too frequent in the history of art, in which the rewards of genius of the highest order have been too long deferred, and too sparingly bestowed. Gifted with a sense of beauty, akin to the spirit of his great countryman Flaxman, and a boldness of conception not unworthy in some of its exhibitions, of the greatest of sculptors, Michael Angelo, he has yet been destined to see men, less highly endowed, step before him into the light of patronage, and commissions pass by his neglected studio, on their way to foreign lands." "It is not to be doubted," continues the writer, "that had Baily been found by his countrymen in the metropolis of his arts, his genius must, amid the strong lights of the everlasting city, have long ago secured for him, in spite of his English name, those triumphs which it is as little to be doubted yet await him." It appears to us that the removal of our Baily from the eternal city, is something like transplanting a rare exotic out of a warm and genial clime, to a cold and sunless country, where if it but chance to put forth its buds, a hard and a killing frost nips them ere they blossom and bear its precious fruit. Abbé du Bas, in his reflections on poetry and painting, has collected a great many observations on the influence which the air, the climate, and other such natural causes, may be supposed to have upon genius.

Before we close this interesting book, we are tempted to make one or two more extracts, which will fully prove the Count's abilities for the task he has undertaken. In describing the *Triumph of Apollo*, a bas-relief by the celebrated sculptor Thorwaldsen, the Count observes:

"This bas-relief represents Apollo attended by the Graces and by Cupids, as he conducts the Muses, eminent poets, and promoters of the fine arts to Mount Parnassus. The first figure is Hyperion, the father of Aurora; he is on the wing, bearing a torch, and is conducting the winged Pegasus. Apollo appears seated in his chariot, drawn by the horse of Helicon; his brow is wreathed with a laurel crown, and in his hands are his harp and plectrum. With impassioned air he sweeps the silver strings, which fill heaven with melody, and render the very stones harmonious. Next follow the Graces, entwined with festoons of flowers, and conducted by an infant Love, while the god of the Cyprian bowers is on the wing, and scatters roses on their decoy path. The fair daughters of Jupiter and Euphrosyne appear in unveiled loveliness, and glide along with the lightness of summer zephyrs. The first among the Muses is Calliope; presiding, as she does, over eloquence, she holds in her hand a scroll, such as Demosthenes might have thundered from as he paced with earnest step the solitary beach of his native Attica. Euterpe, as she plays her favourite lute, joins Terpsichore in the merry dance. Thalia and Melpomene follow, with the characteristic symbols of comedy and tragedy, the pedo or pastoral staff, the mushe and club. Erato, the muse of love, is crowned with roses, and attended by a winged genius with a harp, the golden strings of which he touches lightly with his dimpled fingers, and the air resounds with the soft sighs of the votaries of Erato. Polyhymnia is known by her meditative air, and presiding, as she does, over song and rhetoric, she holds in her hand a scroll. Urania is at once recognized by the globe as the Muse of Astronomy; and Clio, the Muse of history, follows, and is inscribing with a pencil of light, on the annals of Fame, the names of those whose exploits have entitled them to immortality. Mnemosyne, the mother of the Muses, follows near to Clio; she is closely draped, and moves with slow and maternal air. At a short distance from her is Homer, the father of heroic song, who is preceded by a winged genius bearing a palm branch and a wreath of flowers, emblems of his pre-eminence and renown. The venerable bard lifts his sightless eye-balls towards heaven, the source of his inspiration; and, whilst his fingers sweep the strings, his lips give utterance to those epic strains which enrapture gods and men. "Homer," says a modern writer, "transports us to a new and ever fresh creation, in which, though much is calculated to astonish, all appears real, substantial and imperishable. Olympus, with its deities on their golden seats, lies open to our view, in form as palpable as the glorious towers of Troy, the sacred Scamander, and Ida with its hundred springs. Prodigies become familiar to us!"

Such is a brief outline of the bas-relief before us, which combines so many classic beauties of such various characters, that even the *disjecta membra* delight us; but, to catch the spirit of this sublime creation, let us but cast an eye over it for a moment as a whole, and we shall thus learn to appreciate its surpassing excellence, and to estimate, as we ought, the genius of the man whose creative power invented, and whose artistic skill executed, "The Triumph of Apollo."

We will conclude our extracts with a description of the "Terrestrial and Celestial Love," a bas-relief by Gibson, R. A. "This relief is composed of two figures, one representing Terrestrial the other Celestial Love, under the forms of two winged Cupids. They are both contending for the soul, under the form of a butterfly, the emblem of the fair Pryene, who was about to be immolated on the altar of Venus. Celestial love appears in the act of descending from above; he has rescued the soul from Terrestrial Love, and is staying his hand to prevent its pollution at so foul a shrine. In the struggle, Heavenly Love has triumphed over earthly desire; and holding aloft the divine Psyche, he plumes his ethereal wings to bear her aloft to purer and brighter realms. Terrestrial Love holds the torch of Hymen, which he has lighted from the flame burning on the impure altar of Venus; and at the foot of the altar are the fatal instruments of his power, the bow and arrow, and also a pine-apple, the symbol of love.

"This bas-relief is an illustration of one of the tenets of the Platonic philosophy. Plato compared the soul to a small republic, of which the reasoning powers were placed in the head as in a citadel, guarded by the senses, and the tumultuary portion he placed in the inferior parts of the body. He was the first heathen philosopher who maintained the immortality of the soul upon solid arguments, deduced from truth and experience; and he held that the soul, being an emanation from the Divinity, can never remain satisfied with objects or pursuits unworthy of their divine original. According to Plato, supreme happiness is attainable by removing from the material and approaching nearer to the intellectual world, or, in other words, by governing the passions according to the principle of the moral law; and thus, by the practice of virtue, exalting ourselves to an imitation of the Divinity, from whom the soul has proceeded, and to whom, when its affections are thus purified, it is finally to be united in supreme felicity. The beautiful moral thus conveyed by this exquisite composition is too obvious to be dwelt upon. Who has not experienced the struggles of the sensual with the spiritual man? and who has not felt, within his breast, those lofty aspirations which lift the soul above the debasing influence of unholy desire, and fix its affections on another and better world? Nor is the idea of two Cupids struggling for the soul recommended by the simple beauty of its moral alone, but also by its classic taste, for the ancients recognised a celestial as well as a terrestial Venus. "I will not assert," said Socrates, "that there are two Venuses; but as I see that there are temples consecrated to the celestial as well as to the terrestial Venus, and that they sacrificed in the former with ceremonies more sacred and with victims more pure, I presume that two goddesses of that name do exist. The vulgar Venus inflames the passions, and the heavenly Venus invites to virtuous actions.[1]

"It were superfluous to dwell on the artistic merit of this relief; it evinces a mind cast in a classic mould, and possessing a deep and refined sense of the beautiful in conception as well as in form; nor can the harmonious lines of the composition be too much admired or too highly praised."

From our extracts we are sure our readers will agree with us, that the sculptors of Rome have good reason to congratulate themselves on having found in Count Hawks le Grice one who has not only brought their productions favourably before the public, but is very likely to perpetuate their memory. We are indebted to Pliny and Pausanias for a knowledge of some of the noblest pieces of ancient sculpture, many of which have perished; and whatever may be the fate of the works which the Count describes, he is very likely to transmit to posterity their merits, and the honoured names of their authors. We understand that the author has received numerous literary distinctions from various learned bodies; and we have no hesitation in saying, that his "Walks through the study" more than justifies the opinion held of his merits. The style is characterised by an elegant simplicity and classic purity, and the work is enriched throughout with such felicity of illustration and fecundity of invention, as shed a golden glow over its pages and the productions which they describe.

[1] Ε'ικασαις δ'α̂ν και τους ερωτας τηνμεν Παν δημον των σωματων επεμπειν στην δ'Ουρανιαν της ψυχης τε και της φιλιας και των καλων εργων.—Συμποσιον, Senofo... in fine.

Railways, their Uses and Management.—London, Pelham Richardson, 1842.

This is a very interesting epitome of all the railways that have been executed and in progress in this country, and is very ably written, affording a brief insight into their cost, working, and management. The following extract, relative to some of our principal engineers, will be read with some interest.

"Most happy should we be if the undertaking had to depend for its success in Parliament upon its own value without the intervention of counsel, as not only would time and money be thus saved, but the real merits of the proposed work would be brought forward more honestly, or if it had not these pretensions and that recommendation, it would lose a false bolster and fall. It is well known that the skill and science of the different Engineers is frequently useless to them, with all their assured knowledge, by their failure as witnesses. Thus George Stephenson is never put into a witness-box, if his friends can keep him out, he has not the temper for cross-examination by persons he considers ignorant of the subject, and with his opinion of himself, it would be impossible to find any person he would submit to. No man however deserves more credit than George Stephenson, for the manner he has advanced himself in the world, which is in itself no greater proof of his natural abilities, than his acknowledgment of it, is of his real unaffected excellence of heart: he is however a theorist of the wildest kind, and until he became a coal owner, felt that the first things in the world were railways and the first person George Stephenson. He has, notwithstanding his energy and knowledge of coals, failed to introduce them into public use at a reduction in their price, as he promised he would, and no inland coal will do so, however much its introduction into the metropolis may interfere with the sea-born supply. His railways are not always the best or most profitable, and we think he has made a mistake also in becoming chairman of any railway company. Robert Stephenson, with a higher education is more calm and self-possessed and makes a better witness. Walker, sharp, quick and clever, may always be relied upon for all he undertakes. Sir John Rennie, however, possessed of all the knowledge on the subject, cannot stand the badgering of counsel and forgets his professional service in his gentlemanly feelings. George Rennie is too retired and modest to make known his extensive information and much mechanical knowledge under the ordinary examination of counsel—he must be drawn out, and thus makes an honest, conscientious, and intelligent witness. Young Brunel is clever and self-possessed, and would not be easily put down. Locke's testimony would look hard, matter-of-fact, and solid—economical in all its parts. Giles is hasty, anxious, but determined not to be put down; Cubitt, quiet, calm, and firm. Vignoles, energetic and fiery, looking the very personification of some new and wild theory, to be put into immediate practice by his instrumentality, would rather astonish his audience by his bold expostulations and warm support of them, than convince by his arguments and facts, except in matters of detailed and minute expense in practical experience—his evidence has, however, been largely counted on by his employers. Braithwaite is a clever machinist, with an inquiring mind; and, in our opinion, has been spoilt by being made a railway engineer; in this latter position his only experience is the Eastern Counties line, and his declaration of the correctness of his original estimates for the whole line to Yarmouth, made at a public meeting a year and a half after obtaining the act, will hardly add to the confidence of the public in his future undertakings; his self-opinion and readiness will always support him, whether as a witness or advocate. Bidder is, perhaps, the most perfect witness; for though Rastrick has the hardest mouth of any, and the most imperturable determination not to be beaten—yet Bidder, with all the same pertinacity has, in addition, an effrontery of manner (however unintentional) which defies the most resolute opposition; Gibbs is honest and straightforward, and having bought his experience on estimates somewhat dearly on the Croydon, would never again deceive himself, or others."

Year Book of Facts. London: Tilt and Bogue. 1843.

This very useful annual abounds with a store of information extracted from numerous scientific periodicals and daily papers of the past year, and which exhibits the progress of science during that period.

A Hand Book for Plain and Ornamental Mapping and Engineering Drawing. By Benjamin P. Whime, C.E. Part IV.

This part, like the previous numbers, contains some useful examples for reference; among others are sections of stratified rocks, titles for maps and designs, Gothic letters, &c.

NOTES ON STEAM NAVIGATION.

Slide Valves.—As the formulæ we gave on a former occasion in reference to the effect of any particular quantity of lap on slide valves, have not, we understand, been thoroughly understood by the less scientific portion of our readers, it may be useful to reduce them to the form of common arithmetical rules.

To find at what part of the stroke the steam is cut off.

Rule.—Divide the cover on the steam side by half the stroke of the valve. Find by a table of *natural* sines the arc whose sine is equal to the quotient. Take the double of the arc thus found and subtract it from 90°. Find (in the same table) the sine of the remainder; add 1 to the sine thus found, and multiply the sum by half the stroke of the piston. The product will be the space travelled over by the piston before the steam is cut off.

To find at what part of the stroke the exhaustion passage is closed.

Rule.—Add the cover on the steam side to the cover on the exhausting side, and divide the sum by the length of the valve stroke. Find the arc whose sine is equal to the quotient. Take the double of this arc and subtract it from 90°. Find the sine of the remainder, add one to it, and multiply the sum by half the stroke of the piston. The product is the space passed over by the piston before the exhausting passage is closed.

To find at what part of the stroke the exhaustion passage is opened.

Rule.—Subtract the cover on the exhausting side from the cover on the steam side. Divide the remainder by half the length of the valve stroke. Find the arc whose sine is equal to the quotient. Subtract this arc from 90°, and find the sine of the remainder. Add 1 to it, and multiply by half the stroke of the piston. The product is the space passed over by the piston before the exhaustion passage opens at the opposite end of the cylinder.

All dimensions must of course be taken in the same measure, whether feet or inches. If the eccentric be so placed as to make the steam port be considerably opened at the commencement of the stroke, or so as to give a considerable lead as it is termed, the amount of the lead must be added to the cover on the steam side.

Covering boilers with bricks.—The iron platform above the boiler on which the coal generally rests, becomes quickly worn away by oxidation, and the boiler beneath it is generally much injured from the same cause, the whole top of the boiler being necessarily inaccessible, thereby imposing an insuperable obstacle to painting and even to inspection. To obviate these evils, as well as to prevent the escape of the heat, a covering of bricks set in Roman cement was some years ago applied to the boilers of the steam vessel Tagus, and has been found to accomplish its purpose effectually. Upon this covering of bricks the coals repose—the expence of an iron platform, and what is more important, the expence and inconvenience consequent upon its constant repair have thus been avoided, the shell of the boiler is preserved from corrosion, the intolerable heat of the coal boxes is obviated, and fuel saved by the conservation of the heat. The expedient is an exceedingly economical one, and we look upon it as effectual and judicious in every respect.

We have received another letter from Greenock, signed J. G. Lawrie, respecting the formula we gave in our *Notes on Steam Navigation*, respecting the heat contained in surcharged steam, and in which our correspondent says, "I again assert, in the face of the denial in your last number, that the formula is misapplied." The best mode, perhaps, to refute the alleged misapplication, is to investigate the question by an independent method, in order to see whether the same results are obtained; and should our readers afterwards conclude that the "total misapplication" applies rather to our correspondent's correction than to our original statement, we are at least not responsible for the discourteous manner in which the intimation is conveyed.

(1) When air is heated, it expands, and the increments of volume are proportional to the increments of temperature. Every increment of 1° in temperature produces an increase in volume $\frac{1}{480}$ part of the bulk of the air at 32°. This rule has been found to apply to steam out of contact with water.—(Thomsen on Heat.)

(2) The specific heat of steam out of contact with water is inversely as its specific gravity, and at 212 and saturated is ·847. From these data, the amount of advantage derivable from the use of surcharged steam may be computed.

Let t' = temperature to which the steam is raised out of contact with water.

s = mean specific heat of the steam between the temperatures 212° and t'.

v = the volume of steam at the temperature t'—the volume at 212° being 100.

x = the volume of the same weight of steam at 32°, supposing that it could be cooled to 32° without condensing.

h = heat required to raise 100 volumes of steam from 212° to t'

b = weight of water in 100 volumes af steam at 212°.

c = heat required to raise the temperature of a quantity of water $= b$ 1°.

h' = heat required to generate *from* water at 60° a quantity of steam equal in volume to $v - 100$.

From (1) we have $x + x \times \frac{1}{480} (212 - 32) = 100$ or (since $\frac{1}{480} = \cdot 002083$) $x + x \times \cdot 002083 \times 180 = 100 : \cdot x (1 + \cdot 37494) = 100$ or $x = \frac{100}{1 \cdot 37494}$

From (1) also we get $v = 100 + x \times \cdot 002083 (t' - 212)$ which by substituting the value of x previously found becomes $v = 100 + \frac{\cdot 2083 (t' - 212)}{1 \cdot 37494}$

From (2) we find $100 : v : : \cdot 847 :$ specific heat at the temperature t' which is therefore $\frac{\cdot 8470}{100}$ hence

$$s = \tfrac{1}{2} \left(\frac{\cdot 8470}{100} + \cdot 847 \right)$$ or by substituting the value of v.

$$s = \tfrac{1}{2} \left(\cdot 847 + \frac{\cdot 001764 (t' - 212)}{1 \cdot 37494} + \cdot 847 \right)$$

$$= \cdot 847 + \frac{\cdot 000882 (t' - 212)}{1 \cdot 37494}$$

But $h = (t' - 212)\, s\, c$, which by substituting the value of s becomes

$$h = \left\{ \cdot 847 (t' - 212) + \frac{\cdot 000882 (t' - 212)^2}{\cdot 137494} \right\} c$$

Now the addition to the volume of steam produced by heating it from 212° to $t' = v - 100 = \frac{\cdot 2083 (t' - 212)}{1 \cdot 37494}$ and the water in an equal volume, may be found by this proportion

$$100 : b : \frac{\cdot 2083 (t' - 212)}{1 \cdot 37491} \cdot \frac{\cdot 002083 (t' - 212)\, b}{1 \cdot 37491}$$

= weight of water in a quantity of steam, whose volume at 212 is $v - 100$. Hence, supposing the latent heat of steam to be 1000° we have

$$h = (1000 + 150)\, c \times \frac{\cdot 002083 (t' - 212)}{1 \cdot 37494} = \frac{2 \cdot 3954 (t' - 212)}{1 \cdot 37494} c$$

Now since h = heat required to produce an additional volume of steam equal to $v - 100$ by heating the steam out of contact with water, and since h' = the heat required to make the same addition to the volume of the steam by generating it from water, it follows that the saving of heat by using the former method is $h' - h$

$$= \frac{2 \cdot 3954 (t' - 212)\, c}{1 \cdot 37494} - \left\{ \cdot 847 (t' - 212) + \frac{\cdot 000882 (t' - 212)^2}{1 \cdot 37494} \right\} c$$

which reduced $= \frac{1 \cdot 2308 (t' - 212) - \cdot 000882 (t' - 212)^2\, c.}{1 \cdot 37494}$

The weight of water in steam equal in volume to v at 212° is evidently $b \frac{v}{100}$ consequently the heat required to generate from water steam equal in volume to v, is $b \frac{v}{100} \cdot \frac{1150 c}{b}$ which by substituting the value of b becomes $1150 \left(1 + \frac{\cdot 00283 (t' - 212)}{1 \cdot 37494} \right) c$

And this being reduced gives the whole heat required to raise steam equal in volume to v from water

$$= \frac{1581 \cdot 181 + 2 \cdot 3954 (t' - 212)}{1 \cdot 37494} c$$

consequently by this formula the heat saved is expressed in parts of the whole heat used in generating steam in the usual way

$$h' - h \cdot \frac{1 \cdot 37494}{1581 \cdot 181 + 2 \cdot 3954 (t' - 212)} \cdot \frac{1}{c}$$ by substituting this becomes

$$\frac{1 \cdot 2308 (t' - 212) - \cdot 000882 (t' - 212)^2}{1581 \cdot 181 \times 2 \cdot 3954 (t' - 212)}$$

If the steam be heated to 600° then $t' = 600°$, and the formula in such case gives the saving equal to about ¼th of the whole fuel used. Our former mode of determination gave the saving at [illegible], or ¼ very nearly. The minute difference arises from the specific heat having been in the one case supposed to be uniform, and in the other to vary inversely as the specific gravity.

SEWERS OF THE METROPOLIS.

To the Worshipful Her Majesty's Justices and Commissioners of Sewers for Holborn and Finsbury Divisions.

[In the last month's *Journal* we offered some observations on the construction of sewers, and reserved the examination of other portions of Mr. Donaldson's address and Mr. Chadwick's report for another occasion. Since writing those observations, we have had put into our hands a very able report drawn up by Mr. Roe, the surveyor to the Holborn and Finsbury divisions of sewers. As this report so fully enters into the subject of "flushing," we abstain from offering any remarks of our own, but leave it in the hands of Mr. Roe, whose experience on the subject, enables him to report upon it far better than we could have done had we attempted it: by a reference to the engraving of Mr. Roe's flushing apparatus, given in the last September number of the *Journal*, Mr. Roe's report will be better understood, and to all those of our professional readers who may take a deep interest in the question, we strongly recommend them to inspect the apparatus fixed in the sewer of Hatton Garden, opposite the office of the Commissioners of Sewers of the Holborn and Finsbury divisions, by an application to the Clerk of the Commissioners, we feel assured that any member of the profession will meet with the same courtesy that we did, and obtain permission to inspect the apparatus.

At the Court, held October, 1842, an order was made "that the surveyor prepare and lay before the next court, a Report as to the result of the use of flushing apparatus for cleansing sewers, with an account of the expense incurred, and probable saving to the Commission, and embracing the general improvements in drainage that have been adopted by this Commission." The surveyor, in obedience to that order, has prepared a report, which he begs respectfully to lay before you.

Several honourable Commissioners at the last court having expressed a desire that the surveyor should give as full explanation as possible of the method of flushing, and as to what effect it would have upon sewers having little or no fall in them, and upon private drains, it seems necessary to enter into some detail of the cause of flushing being suggested from the necessity that exists for using some artificial method to clear large portions of the sewers from the foul deposit that accumulates in them.

The Holborn and Finsbury divisions are peculiarly situate as having no immediate connexion with the River Thames as an outlet, the waters from these divisions having to pass through one or other of the adjoining districts of the city, the Tower Hamlets or Westminster, before reaching the river. The sewage of the Holborn and Finsbury divisions has therefore of necessity been formed to such outlets as the other districts presented for use, and these formerly being put in without a due regard to an extended drainage, the sewers of your Commission have not had the benefit of the best fall that could have been afforded to them. Of late years, the adjoining districts have lowered many of their outlets; but to alter the existing sewers of your Commission to the amended level, would require the rebuilding of about 323.766 feet of sewer, at an expense of about £200,000, exclusive of the cost of connecting sewers where the cutting would be deep, and of connecting existing surface and house drainage with them, which would make the total amount of cost nearly a quarter of a million. Still, as the lowering of those outlets has taken place, you have availed yourselves of them to a considerable extent; witness the line of sewer to Holloway, the City Road line, the Goswell-street and Golden-lane lines, and several others, varying in length from one to four miles.

The city, some time since, sent to ask you, as data for the improvement of their sewage, the depth of sewage which it would be desirable ultimately to

obtain at the junction of their district with yours;—your answer was, "the greatest depth that can be obtained." In lowering their outlets, the city have accordingly afforded the greatest depth they could; the Tower Hamlets express their intention to do the same. The covered portion of the Holborn and Finsbury divisions appears to be greater than any other district north of the Thames, the return of houses rated to the sewer rate in 1833, as made to the House of Commons, showing an excess of 723 houses above the Westminster district.

In the Holborn and Finsbury divisions there are about 98½ miles of covered sewers for house drainage, exclusive of several miles in length built by individuals, previous to the present regulations being made: there is also about 18½ miles of sewage for the surface drainage, and about 10 miles of open sewers.

In a large proportion of the covered sewers from various causes, accumulations of foul deposit obtain. These accumulations existing beneath the streets in a state of ferment for many years, were a cause of much disagreeable and unhealthy effluvia, and were a further annoyance to the public by choking up the private drains when they attained to any considerable quantity. The remedy for the evil, when complained of, was only to be had by raising the noisome substance in pails to the level of the street, and carting it away; a process which, in itself, was subject to many manifest objections, and made the breaking up of the pavement and roads, and the consequent obstruction of public thoroughfares, unavoidable.

On a general examination into the causes of deposit, one thing that arrested attention was this, viz. that in sewers of the same form and with the same fall or inclination, a different degree of accumulation was found to exist. In some instances this difference was occasioned by the common run of water being greater in quantity in one sewer than another. In other sewers the current of water coming in, where old sewers improperly met at right angles, was found to cause, at the junction of the two streams, an obstruction to the flow along the main line, and here deposit accumulated, and where the collateral sewers were connected with the main line at right angles and at different levels, the obstruction was still greater; for example, in one instance where the collateral sewer was 3 feet above the level of the main line, a deposit was formed of a foot in depth, extending in a shoal up the stream to the length of several hundred feet from the point of junction, while below that point the sewer was perfectly clear. It was also observed, that where a gully neck delivered the surface water of the street or road into the sewer through the crown of the arch, an obstruction was caused in the sewer and deposit accumulated largely on the up-stream side. The whole of these obstructions tended to lessen the capacity of the main line of sewer. The inequality of the bottom of many sewers, and the little fall in others, were causes of accumulation of deposit, and the common run of water in many sewers was found to be insufficient to carry the deposit away.

To remove accumulations from the sewers in a way less offensive than the prevalent mode, to construct the sewers on such principles as were likely to lessen the cause of the formation of deposit, became subjects of consideration. Levels were taken through the Holborn and Finsbury divisions, to ascertain the practicability and expense of remodelling the sewers and rebuilding them at the lowest level which the outlets would afford; but it was found that the level was such as would not give that fall to the sewers as would secure the passing off of the foul matter with the common run of water, and that the utmost that could be obtained would be the natural cleansing of one-half of the sewers, while the remaining portion would still require artificial aid. The cost of lowering the sewers to obtain this partial relief would be, as before stated, nearly a quarter of a million sterling.

This result the surveyor communicated to Mr. Donaldson, the chairman of the Westminster Commission, who, on examining in July 1840, the flushing apparatus now in use, agreed that it would do well for old sewers, but expressed a desire that all new sewers should have such a fall as not to need flushing.

There being a current of water of greater or less quantity in all sewers, in some constant, in others periodical, the idea presented itself of turning this ordinary current to advantage in preventing the accumulation of deposit; and to do so, the use of dams at certain distances asunder, to collect heads of water, was thought of.

A series of experiments was commenced in order to ascertain what velocity could be obtained, and how far such flushes of water would maintain velocity sufficient for the purpose required. These experiments were made with board dams fixed in the sewers, and the results led to the conviction that the deposit might be removed at less expense by this than by the prevalent method. In making experiments it was observed that the effect was the greatest when the dam was removed the quickest. Sufficient data having been acquired, the matter was laid before you, and a great number of openings were directed by the Board to be made in various sewers having different degrees of accumulation, that you might personally see the effect of the plan on an extended scale. The result proving satisfactory, you encouraged the idea, and several of your body made very valuable suggestions upon the various methods of application which were brought before you; and a report was directed to be made upon the system of flushing, and on other suggested improvements which you were pleased to adopt. In that report it was stated that the average yearly cost of cleansing was about 900*l.* per annum. To this there would in future have to be added the cost of cleansing such sewers as had not then been cleansed, but in which deposit was accumulating, and in time would need removal. An example of this class of sewers may be seen in the extensive sewage on the Whiskin estate, Clerkenwell. These sewers have been built about twenty years, and have not required cleansing until this winter. The different degrees of accumulation in these sewers show also many of the causes of accumulation where sewers are well built and have a good fall in them. For instance, the sewer in Meredith Street having a constant flow of water turned through it from St. John Street Road is kept free from deposit, whilst in the sewers in Whiskin Street, Skinner Street, Coburg Street, and the upper part of Gloster Street, the common run of water being too small to keep them clear, deposit accumulates; and in the lower part of Gloster Street, where the junction with Meredith Street was at right angles, the deposit had accumulated to nearly twice the depth that it had done in the other sewers. Of this class of sewers that would gradually come under the necessity of cleansing, there is about 97,498 feet, which, estimated at the quantity of deposit contained in the above named sewers, would, by the old method of cleansing, involve an expense of 244*l.* per annum, in addition to the sum before named.

In the Report before named, it was stated that if the average sum which the cleansing then cost was applied for seven years, and the cleansing done by flushing, the apparatus and side entrances might be fixed to the sewers without any extra charge whatever, and the public would, at the end of that period, derive the benefit of a saving of nearly 800*l.* per annum, besides securing, during those years and for the future, a saving of 300*l.* per annum in the item of cleansing, which the Commissioners had effected under their then existing contracts. The flushing system being adopted by you, the method of carrying it out was ordered to be as follows, viz. that when a sewer was complained of and required cleansing, the foul deposit should be flushed away, and apparatus fixed to enable it to be kept free from accumulations of deposit in future. The result to this time is as follows. Since the commencement of the system of flushing, the foul deposit has been washed away from about 16 miles in length of old sewers, on which have been placed 59 side entrances and 67 flushing gates. After deducting from the cost of removing this deposit by the old method, the expense of all the side entrances and flushing gates, there remains a saving of 445*l.* 13*s.* 6*d.*, and the side entrances and apparatus are furnished for future use. These sewers are about 2-7ths of those that appear to have deposit accumulate in them; and 2-7ths of the average annual cost of cleansing by the old method would be 326*l.* 17*s.* The annual cost for men to work these gates is 106*l.*, forming a saving of 220*l.* per annum on these 2-7ths of the sewers. The total cost of flushing apparatus to these 2-7ths of the length of the sewers has been 434*l.* thus whenever that apparatus should require renewing, the amount of two years' saving will renew the whole. It is not likely they will require renewing for between 30 and 40 years, if then. It is very probable that the interest of the saving will keep the apparatus renewed. There is also the saving to individuals of the cost of cleansing private drains, which, by the system of flushing, can never become choked by accumulations in the sewers as heretofore; and when it is considered that many sewers required cleansing every fifth year, the amount of expense and annoyance must have been considerable. Another benefit has been the avoidance of breaking up the pavement and roads, the cost of replacing which for holes that must have been made to cleanse the sewers that have been flushed, would have been 370*l.* The raising large quantities of foul deposit to the surface, to the annoyance of the inhabitants and passengers, has been prevented. And the side entrances and flushing where they occur have afforded facilities for the men to rake the deposit from old gullyholes into the sewers, from whence it is washed away, thus preventing the breaking up the paving round the gully-holes, and a saving in the article of cartage of the deposit. In one year and a half the saving from this cause in the amount paid for reinstating paving round the gullyholes alone has been 101*l.* 8*s.* 4*d.* A misconception appears to exist that each flushing gate requires a man to look after it; it may not therefore be irrelevant in this place to state that one man will be able to look after and manage all the flushing gates that may be placed in a district containing 15 miles of sewer.

With respect to private drains, the flushing gates are placed on such a principle that, if the whole of them were shut for twelve months together, the houses draining into the sewers would not be at all affected by the water in the sewers; but these gates are never shut except periodically to collect a head of water, and after the head is let off the gate is fastened back, so that no obstruction whatever is caused any where by the application of the system of flushing. At present, as above stated, the flushing gates are placed in such a manner that if kept shut for months together, the water would not enter the private drains; but the result of experiments made upon this point was such as induces the surveyor to state it as a matter worthy future consideration.

Several houses by the side of the open part of the River Fleet at Kentish Town, have drains from their privies emptying into the sewers; these drains were nearly filled with privy soil, which exuded and presented a most filthy spectacle along the side of the open sewer. A wooden flushing gate was constructed to pen up the water which rose gradually to such height as to completely fill the drains. The gate being very large, was made to open suddenly, by the simple principle on which the drag chain of a wagon is loosened. When the head was up the gate was opened, and the water rushed away. The effect upon the drains was, that the sudden withdrawal of the water brought out with it, the soil with which they were nearly filled, and left them in as clean a state as they were when first built. It also drew away all the soil and filth from the open sewer, as far as the head of water extended. Since the flushing gates have been fixed, particular notice has been taken what the effect is upon neighbouring districts, through which the waters of these divisions pass before they reach the Thames. The depth of the deposit was measured at every hundred feet length before using the gate; in one instance the length measured was 2440 feet before reaching the main outlet to the river. The gate was then shut, and a head 2 ft. 6 in. in height obtained, containing about 208 hogsheads of water; this head was let off, and then the whole length of sewer was again examined, when it was found that the deposit had been washed away in the whole length. In another instance the head of water was 3 ft. in height; and this was found to wash deposit away for the whole length of 3250 feet, that being the length from the gate to the main outlet. The total length of continuous sewer that a head of water at one flushing gate would serve to keep free from accumulations, has not yet been ascertained, the greatest length by experiment being 3250 feet, as just stated; but from the velocity of the current when it reached the extreme end, and the depth of water the head furnished at that point, the surveyor has not the slightest doubt but that more than a mile in length of continuous sewer might be kept clear by the use of one flushing gate.

But the washing away below the gate is not the only benefit derived from heading up water by flushing gates, for the effect which took place, in the manner named in the private drains at Kentish Town, is also beneficially felt at the heads of sewers, and in other situations. The drains from the houses in Eagle Street, Red Lion Square, enter the sewer near the bottom, so that this sewer has required cleansing as often as twice in five years, the depth of deposit being one foot and upwards; this sewer is nearly on a dead level for 300 feet. There is a flushing gate placed so as to head up water in this sewer to a height of one foot eight inches, so that when there was 11 inches of deposit, there was nine inches of water standing over the soil. The head of water was let off, and it was found that an average of 3½ inches in depth of deposit had been drawn away with the water from 300 feet of sewer by this one head.

The accumulation of deposit in this sewer is prevented by this process, which occupies a man rather less than one day in the year. The East Long Alley, and part of the Moor's Alley sewer, have bottoms of the most irregular description; the cleansing the deposit from these formerly cost on an average 16*l.* per annum: the accumulations are now kept down by a flushing gate of three feet in height, penning up the common run of water; to work which, occupies a man rather less than three days in the year.

The open sewer at the back of Glo'ster Street, Hoxton, was formerly so offensive in the summer season, that one of the inhabitants, from that cause only, petitioned for leave to arch over, at his own expense, the portion opposite his premises, which was accordingly done. But since you have placed a flushing gate in the covered sewer which empties into this open sewer, the use of that gate has not only kept down the accumulations in the covered sewer, but has had the effect of keeping the open sewer in question clear for its length of several hundred feet, thus preventing the dangerous nuisance which formerly existed. The saving in this instance is greater than that named as effected in the East Long Alley sewer.

In regard to the effects of flushing the deposit into the river Thames, the surveyor has made observations, and taken measurements, which enable him to arrive at the conclusion, that rather more than 14-15ths of the soil and impurities that entered the sewers in the Holborn and Finsbury divisions, was washed to the Thames by occasional rains, and the common run of water in the sewers.

That much road drift is swept through the gully grates into the sewers is certain. In Bedford Place, which has been lately flushed, the depth of deposit was nearly four feet; and amongst this was found a layer of road drift in one part, nine inches in thickness.

In concluding this portion of the report, it may be in general observed, that if there be running through a sewer, a sufficient body of water with sufficient velocity to prevent deposits, *that*, of course, is the best arrangement. But such an arrangement can only be obtained in main lines of sewers, unless a considerable expense be incurred in the purchase of water; and this expense would far exceed the expense of cleansing by flushing. But where there is not a run of water of sufficient body to keep the sewers clear, there is, and must be, a deposit.

A convincing proof of this appears in the sewer, in a part of Holborn, which is in the Westminster district, and which is connected with the Essex Street sewer, which has been lowered from its outfall at the Thames into Holborn, and thence along Museum Street, Bloomsbury, to the boundary of that district; to which point it was completed in 1839. Yet with the advantage of a connexion with a sewer lowered from the Thames, and at a point very little more than a mile from the river, this part of the Holborn sewer has a considerable accumulation of deposit in it.

The New River Company expressed their willingness to supply water at certain seasons at a moderate expense to your Commission, where it might be needed for flushing; but at present, the common run of water, by being penned up at intervals, has been found sufficient for the purpose. The use of flushing gates, supplies the want of a sufficient fall in the sewers, and also the want of a continuous and sufficient flow of water at a much less expense than the cost of the prevalent filthy method of clearing the sewers from accumulations of deposit.

Where there is not a sufficient fall and flow of water, then by damming up the common run of water and letting it off suddenly, an artificial fall of the water is obtained, which answers the purpose. The ordinary fall at which it is required that sewers shall be put in at, is about 5½ feet for the half mile; there are, however, cases where such a fall cannot be got: it is found at Eton, for example, that a fall cannot be got of more than two feet in half a mile, and in parts of Hamburgh not even of half that height. Under such circumstances, unless there be a large body of water, with an adequate flow, there must be a deposit. It is in such cases that the flushing apparatus, collecting the common run of water supplies a remedy. If a continuous line of sewer were formed on a dead level, and if the water be raised by a dam 5½ feet, then when the water is discharged, it has the effect of sweeping away silt, or of keeping half a mile of continuous sewer clear from deposit, producing the same effect as a fall of 5½ feet in the half mile with a continuous flow of water.

When the surveyor first suggested the present method of application to the principle of flushing, he asked your permission to take out a patent for it; but your opinion being that it should be left open for the use of any who might wish to adopt it, he did not proceed therein; as from its promising to prove a saving of considerable amount to the public at large, you as a public body did not wish a monopoly to be made of it; and in accordance with this spirit other Commissions of sewers were invited to inspect it.

Many persons, interested in sewage, have looked at the flushing apparatus used in these divisions, and the surveyor being desirous of the best possible plan, has always expressed his wish that any one would suggest anything that might answer the purpose better, but as yet he has not been favoured with any suggestion on the subject. Much approbation was expressed by many, and one surveyor of sewers considered it clever; Mr. Lindley, who is employed to lay out the new sewage for Hamburgh, expressed his high satisfaction with the plan, and at the clean state in which the sewers are kept by its use; and considered the curved junctions as an excellent engineering work: and the form of your gullies and shoots the one that should be generally used. Captain Vetch, who has been employed to lay out a plan of sewage for Leeds, suggests flushing for general use, and expresses his intention of using all the improvements you have adopted, in every place where he has any influence.

It is interesting to find that the principle of flushing has been in constant practice for 400 years at Eton College, during which long period the sewers have been kept free from accumulations of deposit by its use.[1] Sluice boards are used to keep up a head of water; these are drawn up with a windlass, but the form of flushing gates used by you is about to be adopted at Eton.

In a communication, from a gentleman, the surveyor sent to France to examine the sewers there, it is stated that there are in Paris about 90 miles in length of covered sewers, the whole of which are constantly and regularly flushed by the use of wooden dams, employing upwards of 80 persons. These flushings with wooden dams, do not, however, clear the bottoms of the sewers from a heavy black deposit which is therefore scraped together, and got by hand to the main line of sewer, where a sufficient head of water is obtained to wash it away. Now, if the method of flushing used in the Holborn and Finsbury divisions was adopted in Paris, six men would be sufficient to manage the whole of the gates; and from the very superior effect obtained by the method you use, the whole of the deposit in every sewer would be washed away without the labour at present used.

The Surrey and Kent Commission have, I am informed, used side entrances to some of their sewers for years; these were covered by a stone, but since, Mr. Ianson, one of the surveyors to that Commission, has seen the safety grating used in your divisions, he has introduced them for the use of their side entrances, and, I believe, one or both of the other surveyors to that Commission have done the same.

[1] The same principle, upon a large scale, has also been in use for many years for scouring harbours and removing bars, as may be seen at Dover, Ramsgate, &c.—ED.

Another improvement that you have adopted, is a form of gully hole and shoot, constructed with radiated bricks, the shoot being half a brick in substance. The form of these is such as to deliver the water and deposit from the surface of the streets into the sewer, in such a direction as to cause no obstruction to the flow of water along the sewer.

There have been 690 gully holes and 13,060 feet of shoot built after this improved manner; the saving in expense is £2149 11s. 9d.

An improved form of grate was also adopted, by the use of which there has been a saving of £422 12s. 6d. effected.

The adoption of the present method of cleansing the gullyholes, introduced in the old system, has effected a saving of £200 3s. 2d.

By the improvement in the form and construction of new sewers, a saving of £1094 6s. 6d. has been effected on 14,591 feet length of sewer. In no case has the curved form of sewer failed; nor were there any struts at all in the new sewer lately built from near Thornhill Bridge to the Model Prison; nor any left in, as none were required.

Every engineer and scientific person must agree that curved work for sewers is stronger than upright walls, where the substance of material is equal. By the use of curved work, you have been enabled to adopt a sewer for the use of short streets, by which a saving of nearly 5s. per foot lineal is effected from the cost of your second size sewer, which, when the great length of sewers required in situations where this sewer will suit, is considered, the item of saving will be found ultimately to reach a very considerable amount.

Of the benefit of curved junctions and proper curves to turns in sewers, it would seem needless to utter one word; and whether it be better for water conduits to have turns with curves, or turns with angles, it could scarcely be expected that there would be two opinions; and in sewers where the water is loaded with foul matter, surely the less obstruction there is to the current the better. Besides, curved junctions are in reality a saving of expense to the public, by preventing occasions of obstruction where deposit would otherwise accumulate.

To illustrate this, take the capital letter T, the head of the T to represent two sewers, the currents of water in which meet at the point where the upright portion of the T touches the head thereof, and then flow down in the direction represented by the stem or upright of the T. this seems bad enough: but a little way along the left portion of the head of the T let another line be drawn perpendicular thereto: this will represent a sewer coming in at right angles with a considerable flow of water, adding to the obstruction formed by the meeting of the other two streams, it being only six feet from that adverse junction: and the natural consequence is, that a very considerable accumulation of deposit has taken place. And if two other lines be drawn across the last perpendicular line, each of those lines will represent two sewers coming into that main line at right angles and opposite to each other, so that the water falling from the sewer or the highest level not only meets and obstructs the current of water in the main sewer, but presents an obstacle to the flow of water from its opposite neighbour, hence considerable deposit has formed in the latter; such consequences accruing from junctions at angles, entail a perpetual expense upon the public in the removal of deposit.

The above is a description of part of a new line of sewer and its junctions, built within the last seven years.

The next improvement which the surveyor has to report upon is, the adoption of side entrances to new sewers in lieu of man-holes or apertures, as formerly used. In the 24,624 feet of new sewer built by your Commission, since this improvement was adopted, side entrances, and such flushing gates as was deemed necessary, have been placed in lieu of apertures, and the saving by so doing has been £1319 11s. In the 21,018 ft. of sewer, petitioned for and built by individuals after the same manner, a saving to them of £782 has been effected, after allowing 25 per cent as their profit, or the amount which a builder might think he could save by doing his own work, instead of paying for it at your contract prices. The avoiding breaking up the pavement or roads, and other advantages which the use of side entrances secures, the surveyor named in his former report on this subject.

The total saving by the adoption of flushing apparatus, and of the other improvements named in this report, in about two years, is £6143 19s.; and 2-7ths of the sewers that require artificial aid in removing deposit are provided with side entrances and flushing apparatus for future use.

On the whole, the amount of immediate saving which it was calculated would be effected by your adoption of the improvements herein named has been exceeded; and this will be the case with the perpetual annual saving; experience showing that by flushing sewers with water, a saving of nearly two-thirds may be made from the cost of the old method of removing deposit. But the fact which is of more importance, in a sanitary point of view, than the expense of removal is, that instead of the two or three thousand tons of refuse, which may be removed for £1000 or £1200 per annum, remaining for years decomposing in the sewers, and generating miasma which penetrates the houses and creates disease there, and escapes, and is diffused in the streets amongst the passengers, the deposit would by the flushing apparatus be removed, with sufficient rapidity to prevent any extensive decomposition or any smell.

The men engaged in cleansing the sewers have a more healthy employment; the laying out of large quantities of foul accumulations on the surface of the streets, which was formerly the practice, is avoided: the pavements of the streets are undisturbed: the putting in drains surreptitiously is easily detected; private individuals are saved from the annoyance of having their drains choked, and the expense of cleansing them in consequence; and these are considerations of future expenditure in sewers, which your systematic adoption of these and other improvements will influence, so as to render your having done so one of those circumstances, the great and beneficial consequences of which will be felt, not only in these kingdoms but in every civilized nation in the earth.

In conclusion, I respectfully beg permission to make a few observations upon the address of the Chairman of the Westminster Commission, lately published and circulated, in consequence of the late sanitary report of the Poor Law Commissioners. At page 30, there is a paragraph, as follows—"The truth is evident, that the Secretary of the Poor Law Commissioners has been content to inform himself, in respect of the Metropolitan Sewage, by special deference to the opinion of one individual, whose object has been to give himself importance, by vaunting his own contrivances, by exalting his own Commission, exaggerating his own success, and with unbecoming boldness casting unjust reflections on the adjoining Commissions, traducing the competency of his brother surveyors of the surrounding jurisdictions."

In the first place, I beg to state that the first communication I had with the Secretary of the Poor Law Commissioners, on this subject, was his sending to me to give information as to sewerage, his questions being founded upon a printed copy of my report to your court, in April, 1840; the only information I gave him appears in the Report, at page 373, to part of page 378, and a quotation at page 61, on the quantity of deposit passing from the sewers to the Thames.

I never endeavoured to show the superiority of the regulations of this Commission, by comparing them with those of other Commissions; and in the few observations I made as to the methods adopted in the neighbouring districts, I endeavoured to show that improvements were in progress.

After my interview with Mr. Chadwick, I informed the surveyor of the Westminster sewers that I had been examined, and expected he would be sent for. Finding from a letter of Mr. Kelsey, the surveyor of the City sewers, that his feelings were much hurt, and that he attributed much of the Secretary's blame to me, I wrote to him, and he sent me an answer, from which the following is an extract.

"Dear Sir,

"Did my letter to the Poor Law Secretary produce no other result than your communication, I should feel highly gratified, for it has entirely disabused my mind of an impression which is by no means confined to myself.

"With your leave, I will show your letter to a gentleman, whose father is connected with another Commission of sewers, for it is well that the ill impression should be counteracted.

"It is much to be regretted that the course which you supposed would be taken was not taken,[2] but advocates of any particular system never want to know the whole truth, but only just as much as can be bent to suit their object."

And I have been informed that Mr. Dowley, the surveyor to the Westminster Commission, never considered that anything personal to him or others was meant by me at all.

In answering the questions of the Poor Law Commissioners' Secretary, I cast no reflection or said one word on the competency of any one: and it is mere assumption to say that Mr. Chadwick has been content to inform himself, in respect to metropolitan sewerage, from me only, when the many quotations he brings from others show the contrary.

As to exalting my own Commission, it needs not my feeble praise; its own acts—the scientific knowledge of its members—the attention given to every sort of improvement, will ever produce for it that meed of praise in the public mind which is justly due. I have always been ready to give every information in my power to anyone that asks for it: but, that little is rightly known of what is doing in this Commission, or how it is done, is very evident; a fact, which the Report I this day have the honour to lay before you, will confirm.

I have the honour to remain,
Gentlemen,
Your obedient and faithful servant,

Jan. 27th, 1843. John Roe.

[2] That of other surveyors of sewers being examined.

NOTES ON EARTH WORK, EXCAVATION, CUTTING, AND FORMING EMBANKMENT UPON RAILWAYS.

Article V.—Tenders, Schedules, and Securities.

The preceding paper treated on the supervision of works during their progress; in the present one I will endeavour to give a sketch of the custom prevailing amongst the various railway works, previous to the actual commencement of works, in the prior operation of advertising the works for competition, and the condition and manner of taking securities. In the general form of contracts, plans, sections and specifications are exhibited, and printed forms of tender, drafts of contracts, and printed schedules are distributed to intending competitors; in some few cases the approximate quantities of the principal works, as earthwork and masonry are given, but the contractor has to satisfy himself both as to quantity and nature of the ground, the companies furnishing him with sections of the strata from actual borings. The directors do not bind themselves to accept the lowest tender, but reserve to themselves the power of accepting any offer which they may think fit. The successful party has to enter into a bond with two securities to the extent of 10 per cent. on the amount of contract. The amount of contract is generally exclusive of permanent way, which is let separately, as also the keeping of the works in repair for twelve months after completion. As regards the permanent way, the Company furnish the material, and the contract is taken only for laying, and perhaps including keys, wooden pins, or small wares. The keeping the roadway in repair has been tendered for by contractors at sometimes six times the amount that the actual cost has been to them. After experience has tested the amount, it has produced a feeling amongst engineers that it is not expedient to include in the contract the keeping the works in repair, but the contract to be ended on the certificate of completion being obtained from the engineer. When the directors meet to receive tenders, it is expected the parties tendering, or an authorized person on their behalf, will attend. The directors make no allowance to the unsuccessful competitors for the expense of their estimates. In some cases the bondsmen of the contractor are bound in a specific amount proportionate to the estimated amount of the contract by the engineer, not a per centage. The time of completion is in some cases stipulated, and a penalty imposed if the works be not completed within the given time, in an increasing ratio, say 100*l*. for the 1st week, 200*l*. for the 2nd week, 300*l*. for the 3rd week, and increasing by 100*l*. per week for each successive week.

The design and responsibility of centreing for bridges, &c. and the onus for the execution of the works are thrown upon the contractor, he is to repair all injuries, from whatever cause, during the execution of the work; he is not to be allowed any day bill for work "expressed or implied" by the specification, and the decision of the engineer is to be final and binding upon the contractor, in all cases where there shall be any dispute or misunderstanding regarding the specification and drawings; and should an insufficient number of men be employed, the engineer is to have full power to take the whole of the works out of the hands of the contractor, seize upon his plant, and cause the work to be finished by any other person. The payments on account are regulated by the certificate of the engineer, and a per centage retained in hand varying from 10 to 20 per cent. Some altercation amongst parties has arisen in their not being allowed to draw for material on the ground and not being in the work. The contractor is made responsible for all damage that may be done to adjoining lands, and for any penalties and forfeitures imposed by the Act of Incorporation as regards crossing canals or public highways. He, the contractor, is to furnish tools and assistants to the engineer in setting out the works, and the engineer has power to remove all materials insufficient as regards the quality at his mere dictum.

I think, as a matter of justice, that the lowest tender should have the contract, provided he obtains the stipulated securities; if the tender be not accepted, the party ought to be paid for his estimate. I consider that the present mode of taking security is unfair and inefficient, and that if penalties are to be exacted for delays, that an equivalent bonus should be given to the contractor for any number of weeks that the works may be completed before the stipulated time. I have, I believe, read attentively all the works in the English language relative to railways, and do not think that this important subject has been treated on by any party, even in the splendidly got up works of Mr. Weale, which merely give the specifications of the quality of materials and mode of execution of the works without note or comment. The practice of London for tenders of buildings under an architect is, that when a work is to be tendered for, the architect appoints a surveyor, and a limited number of contractors of note and reputation are written to, and they appoint another surveyor, who, with the former, make out a bill of quantities which is supplied to each competitor, as also the cost of the estimate, which is included in each tender, and is generally 1½ per cent. on the amount, and which is paid by the successful party. The architect charges 5 per cent. if he superintend and carry the work into execution, and if the job fails for want of capital or change of opinion, the architect only gets paid at the rate of 2½ per cent. on the estimated cost.

I cannot forego this opportunity of directing attention to an article in the *Companion to the British Almanac*, page 21, 1843, on the sanatary condition of the people, where Mr. Chadwick observes that "In the execution of other local works, as sewers, roads, and drains to houses, no care is at present taken to ensure the superintendence of persons of competent skill. Noisy parish brawlers obtain appointments of this nature, and are paid at an extravagant rate for inefficient services occupying only a part of their time. A case is mentioned of an illiterate person receiving a salary of 150*l*. a year, or as much as a lieutenant of engineers and a private, or as much as three serjeants of sappers and miners." Mr. Chadwick, with respect to the other works alluded to, states, a hundred thousand pounds have been received in fees for surveys of new buildings per annum, and that "this sum would be sufficient to pay the whole corps of Royal Engineers, or 240 men of science, and the whole corps of sappers and miners, or nearly 1000 trained men." Mr. Chadwick also observes that under the Tithe Commutation and Parochial Assessment Acts, that "amongst the most satisfactory surveys were those executed by a retired serjeant of sappers and miners." In respect to railways, the point of the government wedge is already introduced, and I would warn the assistant engineers to unite boldly against this attempt to interfere with them.

Whilst extracting from the *Companion to the Almanac*, I cannot forego the temptation of extending my extracts to the "Notes on railways," and the new position assumed by them in page 78, alluding to the Norwich and Yarmouth line: "the difficulty in obtaining the capital was so great, that the scheme was all but abandoned, when a new mode was devised whereby the contracts for the whole works were secured to competent parties, on condition of their investing a large portion of their contract prices in the undertaking; in this instance the contracts were taken at the original estimates of the engineer; still the principle thus adopted might obviously lead to a good deal of jobbing, and is so far to be reprehended." In the above observations I perfectly agree, and have made the extract that this *rara avis in terra* may be more fully known through the *Journal*.

Since writing the above, a special meeting of the London and Birmingham Railway Company has been held (Jan. 16), to consider the expediency of applying to Parliament for an act to make a branch railway from the main line at Blisworth to the city of Peterborough. This meeting is reported in the *Railway Times* (Jan. 21), from which I take the following conversation bearing on the subject. A proprietor asks, "Am I to understand that there is to be no specific contract for the completion of the work from end to end, and that the contract will be advertized in the usual way? I presume it will be a common contract." The chairman replies, "In one sense it will be so certainly, but I trust that in another sense it will be an uncommon one, for I hope it will be done within the amount of the estimate. We do not, however, mean to advertise, but to adopt the now usual course of writing to a certain number of first rate contractors, requesting them to send in tenders within a specified time." Proprietor.—"Then there is no actual guarantee on the part of the contractor that the engineer's estimate will not be exceeded." Chairman.—"We certainly are not now in that position, although, as I said before, the engineer's estimate was accompanied by a tender with a full guarantee for the execution of the works within the sum named." Another proprietor is replied to by the chairman, who says, "I think the honourable proprietor may fairly presume that the estimate will not be exceeded by the mode of tender now proposed. The view of the board was that there ought to be a probability of *reduction* in the terms of the tender, rather than the chance of an increase, and it was that consideration which induced us to determine on *competition*, as far as it can be done with safety. As far, therefore, as the execution of the work goes, I consider that we are in a state of perfect security, and that they will be finished within the estimate." In the above conversation we have the results of the most experienced men as capitalists and engineers that the world has produced, and with as much natural talent as perhaps ever will be produced. From which we learn that the London practice as regards contracts for buildings will be applied to railways, and that competition to too great an extent is unsafe, and that the guarantee of the contractor was for the exe-

cution within the sum named as the estimate; thereby fixing a maximum amount, and that the difficulty arose in fixing a maximum. No mention is made of a schedule, or power of making deductions by any given scale.

Another plan, letting out works, has been adopted on broken works, that is, where companies have taken works out of the hands of contractors, by allowing other parties to finish them, at a per centage on the expenditure of 7 to 10 per cent., a check being kept on the contractor by the companies in the weekly pay bills. I have also known other public works, as gas works, so carried into execution. This system is also applied to the agents of contractors and extensive commercial works, a salary being fixed, and a per centage being given on the amount of profits made by the concern.

From the number of responsibilities and restrictions laid on contractors, as previously enumerated, one would have thought there would have been no necessity for the remark, that competition had taken place to too great an extent, and was unsafe. Do contractors rely for profits on extras and unsettled amounts? there being many amounts which remain unsettled for 10 years after the completion or opening of several railways already executed, or do they rely on the law's delay? let the cause now in Chancery, of Ranger *versus* the Great Western company furnish the reply. Again, as to securities; are there no bubble companies? and on what has the contractor to rely on for letting his plant fall into their hands? I can only think his protection must be the cash in his pocket, and his being ready for active defence. I have known a poor contractor ruined, by having his works pushed in bad weather, and he was obliged to leave the works without redress. Ready money is Aladdin's lamp, and will quicken even the perception of a Lord Chancellor. In settling disputes of this nature, arbitration is sometimes resorted to by public companies, to avoid the law's delay; and engineers of eminence are called in to settle the disputed accounts. In all contracts between companies and contractors, it would be well to name two parties, all as referees, in case of dispute, to curb the sole controul of impetuous or peevish engineers.

The practice of the Board of Ordnance, is to fill up a printed schedule of prices. Take smiths work, for instance, the items enumerated most likely to be wanted, will extend to a hundred articles, of any pattern that the superintending officer may order, as, articles of wrought iron, materials for day-work or for store, cast iron, exclusive of patterns. The tender is to be "at how much per cent., above or below the prices inserted in the schedule, he is willing to contract for the supplies;" and only one rate of per centage must be named above or below all the prices in the schedule; and he is to make out his bill at these prices, and add to or deduct from the total the per centage, according to his tender. The generality of tenders are below the prices of the honourable board. The contracts are taken for a term of years, determinable at any period after one year, on either party giving three months notice. Bondsmen, with two securities bound jointly and severally, are taken for the performance of the contract. The superintending officer has the controul of materials as to quality, and imperfections of workmanship, number of and efficiency of men employed. The contractor is to furnish daily a list of men, and weekly a statement of daywork, and how employed, and a list of articles, if any, to which the schedule will not apply. The bills are delivered within 10 days after the expiration of the current quarter, and payment made in the course of the subsequent quarter. In this account of the practice of the honourable Board of Ordnance, we have undoubtedly the nucleus of the principle adopted by the different railway companies; but the chief point, the principle of a per centage, has not been adopted, which I think is the safest for all parties, the company and contractor. I have known the practice adopted by a friend of mine, in a public work of great extent; he sent a schedule of prices to parties, and they were to tender at per cent. on the amount of work (the bills being priced by the schedule) at which they would execute the works. In this mode there is no definite quantity fixed, and therefore no addition and deductions as the works progress, and therefore there can be no extras so annoying to all parties concerned; it is more assimilating to measure and value, with the exception, that the scale of prices is fixed before the commencement of the works. There is a custom amongst contractors of pricing the body of their contract, at a different ratio from that of the schedule, in the expectation that there will be more extra works than deductions here; I warn all parties that so doing, is decidedly wrong in principle and unexpedient in practice. To avoid the above practice, the Manchester and Leeds Railway company inserted two schedules in their proposals, the first containing a list at which the tender is computed, the second containing a list of extra works: in each schedule above 100 items were enumerated. A difficulty often also arises in the measurement of works, as to the custom of the country or trade; and in railway works it is generally expressed, that net measurement only will be allowed, and that brickwork is to include all foundations, digging, pumping water, and all punning[1] or ramming back of walls, backing bridges, &c.

I will now proceed to say a few words on plans, sections, specifications, forms of tender, drafts of contracts, schedules of prices, &c. The two first explain themselves, and the draft of contract is in the province of the lawyer. The specification is supplementary and general; the latter applies to all contracts on a line of railway, and in one case was so voluminous as to extend to 20 folio pages containing 61 clauses. The 61st clause was to the following effect, and will define what is meant by general. "The whole of this specification is to be taken and construed according to the true intent and meaning of it, and in case of the construction of any part of it appearing doubtful, the opinion of the engineer as to the intent of any such portion is to be binding upon both parties." The supplementary specification describes the particular works referred to in the general clauses, as for contract No. 1. No. 5 L, or any subdivision of a particular line, say commencing at chain No. 21, in a field shown in the plan near ———, and ending at chain No. 306, shown in the plan situate near ———, being in length about 3 miles, 4 furlongs, 5 chains, 7 yards, or thereabouts. In the specification a table of the gradients is given, and the number of the bridges, with detailed plans of each. The form of tender is as follows:—"To the Committee of ———. I, of ———, do propose to make and complete the work of the portion of ——— Railway, (inclusive or exclusive of the permanent way, as the case may be), from ——— to, ——— according to the plans and specification, within the period and upon the terms and conditions mentioned and contained in the draft contract exhibited, for the sum of £ *s.* *d.*, and I have, in the schedule hereto annexed, set forth the prices of the different descriptions of work at which the aggregate amount of this tender is computed, and in case this tender shall be accepted, I hereby undertake to execute a contract according to the draft referred to within 14 days from this date, and propose A B and C D as securities for the due performance of such contract." Again, "I hereby offer to execute the whole of the works described in the specification, &c., and in the event of this tender being accepted, I bind myself to enter into a regular contract, and to find satisfactory security for the due performance of the work, and I agree that the value of any addition to or deduction from the amount of the work specified, shall be calculated at the rates stated in the annexed schedule of prices." In the last case, the real estimate of quantities by the engineer was printed in the schedule, with a description of each kind of work attached, and in the case of the Manchester and Leeds Company before alluded to, the amount of security required was stated in the conditions of the contract; it was, therefore, necessary for the parties tendering to add to their tender. "And I do hereby undertake that A B and C D shall, within a fortnight from this date, execute a bond to be prepared by the Company for that purpose, in a penal sum equal in amount to 10 per cent. on the amount of my tender." The Great Western Railway fixed a definite sum for the bondsmen to become security for on each contract, not a per centage; also that the two sureties be bound jointly and severally with the parties tendering.

Notwithstanding the arbitrary powers of engineers, the complex array of law, and the exaction of bonds, they are all found inefficient as regards keeping contracts within a specific sum, or the gross amount of tenders. Can there then be any thing said in addition to show the inutility of contracts on the usual plan.

I should like to see the principle of tendering now in practice by the Board of Ordnance applied to railways, as before alluded to; and if this plan, with the addition of the quantities (as agreed upon by the contractor and engineer, or by their surveyor) were supplied to intending competitors, I think it would tend to simplify the cost of public works, and at the same time make the officers of supervision and of the executive look more lovingly on each other. I have no doubt, should Government execute the Irish railways, some such system will be adopted by the Board of Trade.

I will, in my next, if leisure permit, enter on the principle and construction of earth wagons, which has not, as yet, had the importance bestowed on it that it deserves. In the mean time allow me to subscribe myself, with all respect,

St. Ann's, Newcastle-upon-Tyne. Your's obediently,

O. T.

[1] The cost of punning, per cubic yard, is about twopence, or half the cost of excavation.

ROYAL ACADEMY.

Professor Cockerell's Lectures on Architecture.

(From the Athenæum.)

Lecture III.

The chronological table[1] offered to the students was designed to assist their study of the history of architecture, so strongly recommended; it was a sketch capable of great development—the intelligent observation of antiquity was an all-important object with the architect. No consideration could confer more importance and dignity on the art than that it was identified with time—that the architect himself was a part of history, and that the marked works he performs were, by the consent of language, termed monuments. Such a table presented at one view the religious and moral, the political and technical influences which have guided and developed the art. Through the early centuries we trace it as one of the most active engines of civilization; but it is long before we find the table rich with the names of patrons, architects, or works, and then with many voids of tedious centuries between. The dearth of wisdom or wealth in governments, or genius or liberality in the individuals, accounts for the barren ages; as naturally as do the contrary for the fruits of all the muses. They follow each other as natural consequences, as effects from causes. And it is glorious to recognize the coincidence of epochs favourable to art with the most wise-hearted and generous spirits of history.

Under whom were those more remarkable buildings of Egypt raised? It was when Sesostris built his library, and pointed to its destination by the significant and enlightened subscription—Ψυχης ιατρειον—"The health of the soul." When were those bright edifices erected which have ever attracted the traveller to Athens from every part of Europe, and still do so? It was when Pericles could discuss the buildings he designed with a Socrates, a Plato, a Phidias, and an Ictinus—and so, with minor splendour, an Augustus, a Justinian, a Medici, a Louis XIV., a Frederick the Great, a George III., or a King of Bavaria, have known how to illustrate their era; and, however a half-sighted economy has calculated and complained of the cost, history may be defied to prove that states have suffered from these expenses; those wise princes knew how fructifying they were in real commercial benefits; and never wanted the address to silence the item-counting economists. "Do you complain of these expenses?" said Pericles; "I will find the remedy. I myself will defray them, provided you will allow my name to be inscribed upon the walls." He might have added—"You are prompt enough to vote money to carry on an Affghan war, on a pretence, into Sicily, and fill Syracuse with carcases, to your own disgrace and ruin; but these expenses, trifling in the comparison, these becoming ornaments, these productive fructifying decencies of a great state, you grudge."

When Louis's accounts of Versailles were made up, and his Minister of Finance asked what was to be done with them—"Burn them," said the monarch. He knew as well as Necker the secret "that the arts and sciences repay with usury the expenses of the state in providing for their exercise and culture." He knew, too, that they formed not a tithe of those arrogant and unsuccessful wars which he waged with all his neighbours.

But why are the two centuries before our era less fertile in names? because the Roman sword began to supersede the olive branch of Olympia: and why again do they cease after the second century of our era? because the Emperor himself (Hadrian) professed the art, and murdered his rival Apollodorus, the last great architect of Greece. And now, for twelve centuries, they are obscure under the antagonist rules of feudal and ecclesiastical aristocracy, and re-appear only with liberty and the muses.

Again, for himself, the architect lays to heart the care and circumspection due to *lasting monuments*, and the penalty which the absence of these is to inflict on him in the curse

Of Ripley and his rule;

and for his patrons, his duty to awaken them to the seriousness of these responsibilities, the compromise of national honour and credit in works which are nothing less than state matters; and were so esteemed in Athens by the appointment of a minister, the δεμιὑργος, answerable for their success. He is humiliated in finding that his own design, with the originality of which he had flattered himself, is but a repetition of former essays. Again, in the contemplation of the slowness of invention, and the imitative nature of our species through centuries. The arch and the dome essayed during 1000 years before they assumed the form of the Pantheon or the Bridge of Narni; and 1400 more are required to accomplish a humble imitation in the dome at Florence. That the Egyptian, Greek and Roman, as if spell-bound, did as their fathers did—that the monuments themselves are but the copies, more or less altered, the successors of a remote ancestry receding into the night of time. Pliny tells us that the temple of Ephesus had been seven times rebuilt. The oldest monuments of Egypt and of Greece, and of our own countries, are composed of fragments of still ones:—

Vixere fortes ante Agamemnona
Multi: sed omnes illacrymabiles
Urgentur ignotique longa
Nocte, carent quia vate sacro.

[1] See two following pages.

"They had no *artist*, and they died."

But the technical reflections on this table are not less instructive. The struggle of 2000 years with the monoliths;—the influence of fashions in the design, and of slavery in the execution, of works, reducing the cost by at least one quarter;—the lever, the lewis, the trochlea, and every engine employed by modern masons, are recognized in all the oldest buildings of the east; Stonehenge being one of the few buildings which displays the infancy of art;—the inferiority of ancient cities in the distant view as a conglomerate of low buildings, to those of the modern world with towers and campaniles;—the changes which customs induce;—the church-bell, which in the seventh century hardly exceeded one cwt., and terrified Clothaire and his troops under the walls of Orleans; then the delight and boast of communities, and gradually becoming 80 tons in the 19th century at Moscow, enlarging during those centuries the towers and structures for its reception, and altering by degrees the whole face of architecture;—the use of glass, in narrow windows in the first century, a vast improvement on Phengytes, used till then; the manufacture of the civilized only, till the 12th century; then infusing colours with unseen lustre—glazing in part only the domestic windows, which had shutters below until the 17th, and now in one sheet filling the entire sash. Meanwhile, architecture bends to this manufacture, and changes its features and proportions with the phases of its improvement. And, lastly, cast-iron, which within 40 years has discovered capacities which will alter the whole structure of buildings. We may say with the poet—

Loin d'ici ce discours vulgaire
Que l'art pour jamais dégénère,
Que tout s'éclipse, tout finit;
La nature est inépassable,
Et le génie infatigable,
Et le Dieu que la rajeunit.

The principle to be inculcated seems then to be the acceptance and employment of every useful element of our art, and so to engraft new features, and bend it to the march of human improvement, as to be consistent with taste, while it is also to the great end of use. Thus we shall obtain new creations in the art—which a servile imitation refuses.

These are amongst the advantageous reflections which the contemplation of the chronological table will give rise to.

This evening the Professor purposed offering some remarks on the principal monuments of civil architecture amongst the ancients. As the ritual prescribed the forms of sacred architecture, so political and civil institutions prescribed those of civil architecture: where monarchs sway we have their palaces, suited to the temporal governor of the earth: regarded as God's vicegerent while living, and as demi-gods when dead, their mausolea endure through all ages, in the Pyramids, or in the Moles Hadriana; and where these are supported by castes, we have the Labyrinth, the Temple Palace, and the treasury—in republics none of these are found, but the temple, the gymnasium, the theatre, the stoa, the basilica, and public works abound; when states are absolutely commercial, as Tyre or Carthage, nothing remains but their name in history; their architecture seems to have been confined to the perishable Trireme.

The uncertainty of future existence made duration in the present the earliest object of solicitude; monuments in the pyramid or the obelisk are the most remote architectural works which have reached us. In 1732 B.C. Jacob raised a memorial to Rachel, "that is the pillar upon Rachel's grave unto this day." "The kings of Egypt," says Diodorus Siculus, did not think that the fragility of the body deserved a solid habitation; indeed, they regarded their palaces as simple lodgings, in which each successively inhabited; but they considered their tombs as their peculiar habitations, as their fixed and perpetual domicile.

The subject of pyramids would never be mentioned without acknowledgment to the labours of Colonel Vyse, which for princely liberality and English endurance and disinterestedness are unparalleled, as indeed also for their great interest, since on this subject, debated for so many centuries, he has left nothing to desire.

But, to the architect, no monument of antiquity could be more precious than the tomb of Absalom, in the valley of Jehosaphat, which is monolithic (for the most part), or rather cut in the living rock, and exhibits an Ionic temple *in antis* (like Solomon's temple), with a Doric entablature, an Egyptian cornice, and a tholus or circular attic, surmounted with a conical top and a pomegranate; all features in perfect correspondence with the reasonable expectations regarding Jewish architecture, which, however original in *plan* and disposition, would never be so in ornamental style, because the comparative smallness of the nation, the fortunes of individuals limited by law, the agricultural habits of the people, their discouragement of taste, and their position between great and flourishing countries so remarkable for its cultivation as to lend their artists to the Jews, whenever occasion demanded, were all opposed to the invention of any peculiar and original style of architecture.

A beautiful representation of this remarkable tomb had appeared in Roberts' "Holy Land;" there could be no doubt as to its identity, since tradition amongst the Jews on such a point might always be accepted as full and sufficient evidence—its perfect correspondence with holy writ (II Samuel, ch. xviii.) is striking:—"Now Absalom in his lifetime had taken and reared up for himself a pillar, which is in the king's dale: for he said, I have no

son to keep my name in remembrance; and he called the pillar after his own name, and it is called unto this day Absalom's place." Wren calls it "the most observable monument of the Tyrian style." "It were to be wished," says he, "some skilful artist would give us the exact dimensions to inches, by which we might have a true idea of the ancient Tyrian manner."

Labyrinths are amongst the earliest and most astonishing of architectural works; they were found in Egypt, Crete, Lemnos, and Tuscany. Herodotus describes them as surpassing in extent and magnificence: the one he describes (Eut. cxlviii.) was composed of 12 courts, having apartments of two kinds, 1500 above the surface of the ground and as many beneath, in which were the tombs of their kings. "No one could enter them," says Diodorus Siculus, "without a guide." Yet Pliny tells us they were not contrived like the ornament commonly called by that name; in that of Lemnos, says he, were 150 columns turned in a lathe, which a child could move; and this is remarkable as evidence of the use of such a machine in the capitals of the Parthenon, which has been always supposed.

The living use of the Labyrinth is left to conjecture; but we may easily conceive their adaptation to a people of castes, with whom they might be colleges for those aristocratic classes surrounding the throne. We are told that all the youth of Egypt, born on the same day with Sesostris, were set apart and educated with the young prince, and thus it was that he found himself surrounded in manhood by attached companions, who carried his conquests and his fame to the greatest height. Where could so vast a generation be educated but in the Labyrinth?

The Professor doubted the interpretation commonly applied to the so called temples of Egypt; he believed them to be rather temple palaces, in which the temporal administration of a great country was carried on, together with the spiritual. The ruins of Karnac covered 10 acres. Within the walls was inclosed a space equal to the whole length of St. James's Street, and four times its width. The comparison of this plan with that of the Louvre and its courts, with the use of which we are familiar (and exhibited with plans of Luxor and Dendera, and Diocletian's palace, and others drawn to the same scale), would show the high improbability of the employment of such vast spaces for the priesthood alone; and it could be shown, especially at Dendera, that all the public business of the realm might be conducted there, and that the Pharaoh himself very probably resided, as in the Arab villages at this day, upon the broad terraces which these vast buildings afforded, raised into the air, and removed from the vermin, inundations, mirage, and confinement, to which the habitations on the soil of Egypt were subject.

The Pharaoh united the offices of monarch and high priest, and all the dignity and imposing awe which the arts could afford, were associated with his presence. The palace was approached through an avenue of sphynxes of a mile in length. The Pylæ were seen afar off raising a vast front of uniform surface, on which were engraved on one side the Pharoah in his warlike attributes reviewing his troops, charging the enemy, whom he annihilates at a stroke, besieging cities; on the other, in his peaceful, administering justice, and the more sacred duties of his priestly office. In front of this were obelisks (the smallest of which is now in Paris), and colossal figures of the Pharaohs.

The first court equals in size Waterloo Place, from the column to Pall Mall. Here, under a colonade, "the King sat in the gate," with "his princes and counsellors;" this was "his porch of judgment," the sculpture and painting of the ceiling symbolized appropriately the passage of the soul through human vicissitudes to a final judgment.

The columnar grove beyond, 325 feet by 266, afforded a waiting hall (the only cool one in Egypt for all the court, so pompously described

BEFORE CHRIST.

Dates, Authors, Patrons, Events.	Architectural Writers.	Eminent Architects.	Buildings.
2400 Noah			
2300			Tower of Babel
2200 Menes			Walls of Babylon
2100 Abraham			Pyramids Obelisks
2000-1900			
1800 Amos or Cheops			 Pyramid
Joseph or Chephren			 Pyramid
1700 1600			 Arch
1500 Sesostris	Moses	Beseleel	Tabernacle Pyramid Temple of Jupiter at Thebes
1400			Labyrinth in Egypt
1300		Dædalus	Labyrinth of Crete
1200 Troy taken			Nineveh Treasuries at Mycene, Orchomenos, &c.
1100	Solomon	Hiram	Temple at Jerusalem
1000 Shishak spoils Jerusalem			
900 Homer—Hesiod			
800 Ezekiel			Cyclopian Walls Labyrinth of Lemnos
700	Theodorus	Rhoecus	Temple of Juno at Samos
	Chersiphron Metagenes	Zoilus Rholus	1st Temple of Diana at Ephesus
			T. of Jupiter Panellenius of Ægina
		Agamedes Trophonius	Temple of Cybele at Sardes
			1st Temple of Apollo Didymeus
600			1st Temple of Pallas at Priene
Ezra		Antistates Calleschros	
Æschylus	Agatarchus Democritus	Antimachides Porinos	1st T. of Jupiter Olympius, Athens
	Anaxagoras Silenus		Temple of Jupiter Olympius, Elis
			Theatre of Bacchus at Athens
500	Ictinus Carpion	Callicrates Mnesicles	Temple of Ceres Eleusina
	Theodorus	Agaptus Libon	Parthenon, Propylæa
Pericles	phoceus.		
	Argelius	Pheax	T. Æsculapius, Tralles. T. Selinus
Herodotus	Satyrus Phyteus		T. Jupiter Olympius, Agrigentum
Thucydides			Mausoleum. Temple at Cyrene
400	Hermogenes Nexaris	Mæsthes Callias	T. Diana, Magnesia. T. Bacchus,
	Pytheus Theocydes	Tarchesius Archias	Teos
	Demophilos Pollis	Daphnis Demetrius	2nd T. Priene. 2nd T. Ephesus
	Leonides Philo	Denocrates Lycicratus	2nd Temple of Apollo
		Peonius	Pharos at Alexandria
	Silanion Melampus	Sostratus Callimachus	Corinthian Capital
300	Sarnacus Euphranor		
		Polycletus	Theatre at Epidaurus
		Andronicus	Tower of the Winds
200		Cosutius	T. Jup. Olym. Athens, completed
			Gymnasia
100	Fussitius	Hermodorus	Temple of Jupiter Stator
	Terrentius Varro Mutius		Temple of Honour and Virtue
Diodorus	Publius Sattimius	Valerius	2nd Temple of Jupiter Capitolinus
Strabo		Saurus Batrachus	
	Vitruvius	Cyrus	Basilica at Fano in Italy

AFTER CHRIST.

DATES, AUTHORS, PATRONS, EVENTS.	ARCHITECTURAL WRITERS.	EMINENT ARCHITECTS.	BUILDINGS.
	COLUMELLA	Vitruvius Cerdo	Baths
Pliny		Seler	Tomb of Augustus
Plutarch		Severus Rabirius	
	FRONTINUS		Amphitheatre at Rome
100			
		Apollodorus	Forum of Trajan
Pausanias		Hadrian	Temple of Venus and Rome
Lucian		Detrianus	Moles Hadriani
Dionysius			Temple of the Sun at Palmyra
			Temple at Balbec
200			
300			
Eusebius		Metrodorus	
Constantine		Alipius	Temple at Jerusalem
400			
500			
Justinian		Anthemius	St. Sophia
		Isidorus	
600			
700			
800		Romualdus	Cathedral of Rheims
			St. Mark's at Venice
900		Elphege	Crypts of Winchester Cathedral
1000		Buschetto	Duomo of Pisa
		Mauritius	Old St. Paul's
		Lanfranc	Choir of Canterbury Cathedral
		De Carilelpho	Durham Cathedral
		Losinga	Norwich Cathedral
1100		Dioti Salvi	Baptistery of Pisa
		Roger	York Cathedral
		Normannus	Lincoln Cathedral
		W. Senensis	Canterbury Cathedral
1200		Troteman	Wells Cathedral
		Poore	Salisbury Cathedral
		Erwin von Steinbach	Minster of Strasburg
		Louton	Lichfield Cathedral
		Arnolfo	S. Maria del Fiore
1300		Agostino da Siena	Cathedral of Sienna
		Walsingham	Ely Cathedral
		Walter	St. Stephen's Chapel
		William of Wykeham	Windsor
1400			
		Brunelleschi	Cupola of S. Maria
Medici	ALBERTI		St. Francis at Rimini
	CATANEO		
		Cesare Cesariano	Milan Cathedral
		Reginald Bray	Henry VIIth's Chapel
1500			
	PHILIBERT DE LORME	Bramante Rafaelle	St. Peter
Leo X.	SANSOVINI	Peruzzi San Micheli	
Julius II.	SERLIO	San Gallo Michelangiolo	Cupola of St. Peter
	VIGNOLA	De Lescott	Louvre
	PALLADIO		
1600	SCAMMOZZI		
	WOTTON		
	INIGO JONES		Whitehall
	PERRAULT	Bernini Borromini	Façade of the Louvre
	CHRISTOPHER WREN		St. Paul's
1700		Mansart	
	BLONCEL	Vanbrugh	Arches of Triumph at Paris
		Hawksmoor	Blenheim House
	CHAMBERS	Gibbs	Somerset House
		Perronet Soufflot	
1800			

Note.—The writings of those in capital letters are still extant.

in Daniel: "the princes, the governors, the captains, the judges, the treasurers, the counsellers, the sheriffs, and the rulers of the provinces." Through these was the approach to the Sekos for the god; and on the face of each column of the avenue were represented on one side Osiris, on the other the Pharaoh.

The paving above all this showed a surface prepared for other buildings, apparently of timber: holes occur for the reception of the posts, very large ornamental spouts for the discharge of sewage and water, IN A COUNTRY OF NO RAIN, and therefore only wanted for the uses of a great family. The parapet walls forming the external face of the temple palace, surmounted with the usual cornice, defend and partially conceal these buildings; and at Dendera especially are chapels for the daily services of the Pharaoh and his family on this higher level, and the staircases by which they arrived at them. These were the "*ivory palaces*," the habitations of cedar, and sandel, and almug woods, alluded to in the 45th Psalm, and in which each Pharaoh might indulge his taste, and be "*glad*," and enjoy exemption from the inconveniences of the nether world.

Some very beautiful drawings, by Mr. Jones, representing the actual remains and restorations of the Pilæ, were obligingly exhibited, by permission of that gentleman. An interesting part of the ruins of Karnac was not to be forgotten, namely, a triumphal gate built by Shishack on his return from Jerusalem, whence he had taken the golden shields put up by Solomon, as described in 1 Kings, xiv.

The treasuries of Atreus, 48 feet in diameter, and the gates of Mycenæ, and the treasury of Orchomenos, of still larger diameter, are the only monuments of Homeric pretension, unless the Lycian remains, discovered by Mr. Fellowes, can be proved to be of that remote period, and that the taste of Sarpedon can be identified by them.

Amongst the objects of civil architecture, few have had more influence on the art than theatres, both in their external elevation, in the application of the orders in relief on the pier and spandrel of the arch, and in the internal elevation, the scene, which has been the occasion of so much caprice and corruption of taste. The theatre, being constantly employed for parliamentary assemblies, required a permanent scene, as well as moveable, and adapted to the performance. It was a subject of vast architectural study and expense. Pliny (lib. xxxvi.) tells us that Caius Antonius silvered the scene; Pretonius gilt it; Quintus Catullus clothed it in ivory. Scaurus surpassed them all; he raised 360 columns, in three ranges: the first was of marble 38 feet high, the next was in glass, the third of wood gilt. Three thousand bronze statues ornamented the intercolumniations. Curion, unable to surpass Scaurus, built two theatres of wood, which, being back to back, could be turned so as to form an amphitheatre for gladiators, displaying the skill of the Roman carpenters to great advantage.

Vitruvius (lib. vii. c. 5,) lamenting the depravation of taste, tells us that Apaturius of Alabanda offered a design for a scene of two stories, the upper called Episcenius, filled with every caprice, centaurs did the office of columns, pediments were twisted in a variety of shapes; all which pleased the people of Tralles, for whom it was designed; but Licinius a mathematician, exposed its absurdity, and it was accordingly reformed on better principles.

The scene of Laodicea (amongst many which the Professor exhibited) was the most extensive, being no less than 254 feet in length. The theatre of Orange, lately published by M. Caristie, was a valuable addition to our information on the Roman scene.

Palladio's scene of the theatre at Vicenza gives the best idea of its feature of ancient architectural magnificence.

Originally of wood, and continuing so for many centuries, it was not until the third century before our era (232 B.C., the theatre at Epidaurus,) that they were built in stone and marble. The Greek

theatre approached the amphitheatre, and was a horse-shoe comprising 200° or more, because the orchestra was reserved also for the performance; but the Roman theatre did not exceed 180°, because the orchestra was occupied by the senators.

The Odeum was a covered theatre, chiefly for music; that of Herodes Atticus, at Athens, was the most magnificent in Greece, and had a roof of cedar. The space covered was 240 feet by 159. The construction of such a roof, without obstructing sight or hearing, or injuring external architecture, offers a problem to the architect of no easy solution, and is one of great interest in the present times, as we are frequently called upon to cover large areas for occasional assemblies.

But as modern theatres were more to the point with students, the Professor called their attention to a magnificent work, lately published on "The great modern theatres of Europe," by M. Contant, which he exhibited.

The amphitheatre was then considered: although of early Tuscan origin, and originally formed in earth or scaffolding, it was not executed in permanent materials till the end of the first century. One in earth had been discovered by Sir C. Wren at Dorchester. That of Vespasian (as shown in a diagram) was too large for the site of Trafalgar Square, Charing Cross, &c. The velarium, 550 feet by 450, with which the colosseum was covered during exhibitions, was a surprising contrivance, and had been made the subject of a work by the architect Fontana. M. Hittorf had suspended the roof of a panorama in the Champs Elysées, somewhat in the manner of the Velarium, with great skill. This work, published, was here exhibited.

The gymnasium, in which the youth of Greece were instructed for the defence and honour of their country, in every department of prowess, was an interesting object of civil architecture. The plan of that of Ephesus, published by the Dilettante Society, was exhibited, and it was gratifying to observe the use which the late Professor Mr. Wilkins had made of this example, in illustration of the text of Vitruvius, which had hitherto been misunderstood.

The Gymnasium was the more interesting as the type of those Thermæ, the Roman baths, which have furnished the great school of architectural instruction, and from which the best inventions of the architects of the middle age, and of the revival, had been derived.

The name, Thermæ, as well as the express declaration of Vitruvius, declare that these institutions were exotic: a refinement adopted from Greece in the time of Augustus. During the first three centuries of our era, seven of these were erected; they were well calculated to indulge that love of luxury which rapidly corrupted the Roman manners under the emperors, as well as to gratify that constant excitement of novelty and splendour, which gave popularity to the government. Some idea of their extent may be conceived from the plan (exhibited) of the Baths of Caracalla laid down upon that plot which is comprised between Regent Street, Pall Mall, St. James's Street, and Piccadilly, covering about 28 acres. Cameron assures us, that those of Diocletian, somewhat larger, afforded hot baths for 18,000 persons at the same time: a bell rung at two o'clock to announce that the water was warm. The mask of a paternal urbanity was often affected by the despotic emperors, who frequently bathed with the people. One day Hadrian recognized an old companion in arms in poverty, scraping himself with a tile instead of the strigil; accosting him kindly, he furnished him with a slave, and all that could be wanted to his future comfort. Such an example could not but be infectious: accordingly when he came again, he was surrounded with poor acquaintances scraping themselves with tiles; but, calling them together, he observed, that being many they could scrape each other, without any superfluous expense of slaves or furniture. The Thermæ were in fact vast clubs, castles of indolence, in which every easy exercise of body or mind, and every delight of the senses might be indulged. The gardens, raised about thirty feet above the general level, were adorned with every fragrant shrub and flower; the choicest works of sculpture, obelisks and fountains, exedræ for the enjoyment of the shade or the sun (of a structure well worthy the student's attention) terminated the walks. In the central building was the great hall, the type of Gothic structure in ecclesiastical architecture, namely, the groined ceiling reposing on a column, and abutting on an extended pier, with the nascent flying buttress. The space of the naves (varying from 76 to 90 feet) being twice that of York, the widest of our cathedrals. The area covered, offers the largest space with the smallest obstruction in the support, of any scheme yet devised, and cannot be too much admired. It has been well observed of those structures, that we discern in them the type of all that has been since done in architecture, just as throughout the animal creation we trace the more or less resemblance to the type man. The interest excited amongst the French students recently (as exhibited in their late competition for the grand prize), promises that this admirable feature of ancient architecture will be reproduced in Europe before many years past. It was proposed for the new Public Library at Cambridge; it was employed by Sir C. Wren in Bow Church, on a small scale; and is executed on a still smaller scale, with considerable differences, but with happy application in the Bank of England, by Sir J. Soane. But the cloisters, the surrounding rooms and baths, their various forms and structures, and the happy union of the arch and the trabeated systems, would lead to more observation than can be here admitted. To the students he would say of them,

Nocturnâ versate manu, versate diurnâ.

Palladio designed to have published a book upon them, the drawings for which were afterwards edited by Lord Burlington. Mons. Blouet has published a magnificent work, giving all the restorations and details, which large excavations and very careful study of them enabled him to obtain.

The Basilica is also of Greek origin, as the name imports. The kingly hall was such as Solomon built in the palace of the forest of Lebanon. It was the Westminster Hall of ancient governments for administration of justice, commercial exchange, great public meetings, &c. The building at Pœstum, so called, was more properly a temple, because the Greeks were not accustomed to apply sacred architecture to civil purposes.

The Basilica of Trajan was the most magnificent exemplar of this species of building which the Professor could point out: with its forum, temples, and approaches, it covered 12 acres. The central hall or basilica, 540 by 168 feet, would contain St. Paul's in length and in width, exceeded only in the extreme ends of the cross. The central nave, 278 by 78, would contain the whole of Westminster Hall, in plan as well as in section. In Rome were 18 basilicas, and one at least in every city of the empire. Their subsequent adaptation to the Christian temple makes them highly interesting to the student. Vitruvius, lib. v. c. 1, describes the basilica, and his own work at Fanum, which differs from the usual form in some particulars.

Lecture IV.

Of the divisions of the art proposed, that of domestic and villa architecture alone remained to be considered. On this subject, two important preliminary remarks were to be made. Firstly, that the republican form of government, which prevailed in the ancient world after the seventh century B.C., greatly influenced the style of domestic buildings, which were expressly unostentatious externally, towards narrow streets, lined with shops, reserving all their elegance for the interior, in the atrium impluviatum—porticatum—the exedra, &c. Secondly, that populations and fashions having been derived from the east, an oriental character was impressed on the ancient habits and arrangements of countries in which (as in Italy especially) the northern and occidental now prevail as derived from an opposite source. Whoever walks through the streets of Pompeia, after having resided amongst the Turks, will be struck with this fact. The profuse employment of water, in the bath, the impluvium, and in the corner of every street—the narrow street—the secluded mansions, within high walls—the internal air and space—the subdivision of the house into the men's apartments and the women's—the harem—the lightness of the costume—all express migration from warmer climates, and a marked distinction of the races of modern and ancient inhabitants.

The Jews lived chiefly on the terraced tops of the houses, as the Professor presumed the Pharaoh to have done. "Ahaziah" (II Kings, c. [illegible]), king of Samaria, "fell down through a lattice in his upper chamber;" and it was thence that David, in a wanton moment, incurred the curse which fell upon his family. The house top is ever the scene of prayer. "Let him that is on the house top," says our Saviour, "not come down unto his house, neither enter therein," (Mark. xiii. 15); yet it is possible that in the latter ages they had adopted the Greek and Roman ichnography—and was perhaps, through the roof of the atrium testudinatum that the sick man was let down to be cured by our Saviour (Luke, v. 19.)

The narrowness of the streets, and unostentatious style of the houses in Athens, occasioned disappointment to the traveller, as Dicæarchus expressly tells us; in Rome the same; and as the houses were *limited* by the Augustan law to 70 feet high, we must suppose them unattractive. The fragments of the great plan of Rome, inscribed on the pavement of the temple of Romulus, by order of Septimius Severus, and published by Bellori, show the resemblance of the houses to those of Pompeia. It was an extraordinary innovation on the ancient humility of the Roman house, which Cæsar proposed, in demanding permission of the Senate to erect a fastigium, or pediment, over his door.

But the complete account of the Roman aristocratic house is to be found in the "Palais de Scaurus," by Mons. Mazois, as also of the citizen's house, in the "Ruines de Pompeia," so admirably illustrated by that ingenious and lamented architect.

But if the Roman nobles accomplished the admirable works described, in favour of the public, they did not neglect their own comforts. Under the empire they lived as individuals with the income of monarchs; and Strabo tells us expressly that "they built their villas after the palaces of the kings of Persia." The number of them was also extraordinary; for, as Lucullus said, "they were as wise as those birds which change their residence with the seasons."

Cicero had 19 villas, and it was in one of these that Cæsar honoured him with a morning call, and paid him the very high compliment of taking a vomit in order that he might do justice to his lunch. In another he delighted to ornament his library with Greek paintings and sculptures, which his friend Herodes Atticus was always collecting for him.

It was a fortunate legacy to the architect-antiquary which Pliny had left, in the description of his villa at Laurentinum. It had often employed the ingenuity of the architect, since the revival, but with small profit, till the discovery of the ancient ichnography of Pompeia. The Professor exhibited his own restoration, founded upon those data, in which, though he differed in some points from his accomplished friend, Mons. Haudebourt, in his elegant version of the Laurentinum, yet he strongly recommended it to the student, on account of the great research and taste shown in the composi-

tion. Some of the features he would describe. You entered a small tarium and thence a court in the form of the letter D, surrounded with a portico, which was enclosed partially with glass (the very original of our old conventual cloisters), and thus excluded rough weather. Thence through a gay court into a triclinium, which hung over the sea, and had windows all round three sides, giving the full enjoyment of the air, and view of wood and mountains beyond. To the left of this was a room at the end of which was a rotunda (in apside curvatum), so contrived as to receive the sun's rays from the rising to the setting: in this was a case containing books, calculated to detain you, and such as "one loves to read over and over again." This arrangement afforded an angular parterre, protected on all sides except the south from the winds, and concentrating the sun's rays—a delightful refuge in the winter season. There were rooms heated by pipes from a hypocaustum, and others to retire to in stormy weather, to escape the roaring of the waves; a large bath for cold and hot bathing; a perfumery; and spheristerium, or fives court; a long gallery (crypto porticus) with windows on either side, which, when opened, admitted the fragrance of beds of violet and the sun's rays at the rising and setting. "At the end of this," continues Pliny, "is a casino I built myself—my delight: in it I have an *Heliocaminus*, a sun chamber, warmed by windows all round; while reposing on my couch in a recess adjoining, I can see the garden, the landscape, and the sea through a *glazed door*; I can study in perfect quiet here, and escape all the noise and disturbance of my servants, occasioned by the Saturnalia."

Pliny omits some features of great interest in the Roman house, as the Sacrarium (the chapel,) in which the Lares (the household gods,) were placed, and sometimes the imagines majorum, of which the Romans, like ourselves, were justly proud. The Tablinium, for the archives, which also received these sometimes; and the Ergastulum, that room of the domestic side of the house in which chastisement was administered to the slaves, in the approved fashion of our schools at this day, as we see by various paintings preserved to us.

Pliny describes his gardens, his figs and mulberries, his gestatio bordered with box, and plantations disposed in the form of Xystus and the Hippodrome; classical titles, which give a charm to features otherwise insignificant and since "the world," says Sir C. Wren, "is governed by wordes," they may often be adopted by the architect with good effect, when introduced appropriately and without pedantry.

The attention to the sun's rays in the milder climate of Italy, so conspicuously shown in Pliny's letters, is confirmed by all the authorities of antiquity.

Vitruvius (b. 6, c. vii.) is very particular in his recommendations to this effect: but the wisest of men, in a still warmer climate, has enforced this point yet more strikingly:—"To make a house pleasant," says Socrates, "it should be cool in summer and warm in winter: the building, therefore, which looks towards the south will best secure these objects, for the sun which will enter into the rooms in winter, will, by its greater altitude, pass over its roof in summer. For the same reason, these houses ought to be carried up to a considerable height, the better to admit the winter's sun; whilst the side to the north should be left much lower, as less exposed to the bleak winds from that quarter: for, in short," continues he, "that house is to be regarded as beautiful where a man may pass every season of the year pleasantly, and lodge whatever belongs to him in security."

The modern Italians are not less attentive to aspect, which they significantly express by the proverb, "Dove non viene il sole, viene il medico."

But the most extraordinary villa of the ancient world, was that of Hadrian, at Tivoli, in which he displayed all the acquirements and collections of taste, during 21 years of constant travel through this vast empire; in it was reproduced every remarkable building of the world, and probably every statue of celebrity, since from this magazine the baths of Caracalla were furnished 80 years after, and the Vatican in some of its most precious ornaments. The whole was said to be inclosed in a wall 10 miles in circumference. Pizzo Legorio, Kircher, Contini, and Panini, have engraved and written upon the remains.

The modern villas of Rome, built by the popes and cardinals since the 15th century, convey to us some of those graces in which the ancient villas abounded. In these all the great masters of the revival have displayed their research and ingenuity. They are described in the elegant work of Messrs. Percier and Fontaine, to which the Villa Pia, by Mons. Boucher, has lately been added.

Our own architects of the 16th, encouraged by Bacon, Burleigh, and Wotton, certainly studied these works, and engrafted some of their principles on our Elizabethan architecture, which adapts itself admirably to our climate and the extent of our establishments. Bacon (Essays, vol. I.) describes his idea of a villa with great detail, insisting upon the aspect and the seasons as primary considerations. Indeed, all authorities agree upon this subject, except those of the 19th century, and especially the patentees of hot air or hot water apparatus.

"The Elements of Architecture," by Sir Henry Wotton, being "the Rules and Cautions of this Art cast into a Comportable Method," are amongst the most precious and the earliest in our language. He was long ambassador at Venice, from Elizabeth and James, and seems to have been personally acquainted woith Palladio. Domestic and villa architecture are special subjects with him; for, says he, "Every man's proper mansion and home being the theater of his hospitalitie, the seat of self-fruition, the comfortablest part of his own life, the noblest part of his son's inheritence, a kind of private princedome, nay, to the possessor himself an epitome of the whole worlde, may well deserve by these attributes according to the degree of the master, to be decently and delightfully adorned."

In truth, during three centuries the cultivation of this branch of architecture may be said to be peculiar to England, and that, while monumental and palatial edifices are better illustrated on the continent, the constitution of this country, and of the English mind—prone to the salutary retirements of home, the centre to which all its desires and warmest imaginings are ever pointing—have made the English house of every grade the most perfect in comfort and convenience, and the villa the beau idéal of individual possession, and the branch of the art in which our country excels beyond all others.

The compact square villa, after Palladio especially, was introduced by Inigo Jones, and much advanced by the model of those at Genoa, published by Rubens, who recommends them as full of beauty and convenience, and admirably suited to gentlemen of moderate fortune, such as the republic of Genoa is composed of. But the extension of the habits and the requirements of the present day have outgrown the spuare villa, and we are constrained to build a house beside the villa to accommodate them, with the worst possible effect in the group and in detail; for in vain the plantation attempts to hide it out; an anomalous composition is the result, and we had better have reverted to the Elizabethan mansion, which cast the house and offices into one in the extended E or H, or the French mansion, "enter cour et jardin," of the 18th century, reserving the centre for the best apartments, and the wings for offices, and the entrances in the angles communicating easily with all.

The least rational of English productions in this sort is seen in the castellated elevation adapted to this plan—the battlements and dungeon-keeps of Edward the Third upon the Italian villa of the 16th and 17th centuries. The menacing aspect, the machicolations, threatening hot lead upon the intruders, in the distance, are, on the approach, found to be peaceful and harmless; the fortress is accessible at every window, and expresses a security from danger on better acquaintance, in direct contradiction to its fortified exterior. On entering the baronial hall, where you expect the paraphenalia of chivalry and the chase, retainers and bondsmen, you are addressed by a powdered footman, or may discover a housemaid sweeping the marble pavement.

The Grecian villa is hardly better conceived; it may be taken for a library, or a philosophical institution. An extensive portico, borrowed from Minerva Polias, imposes its order on the whole composition, which is to be compressed accordingly, at the cost of all its internal proportions and accommodations. Every useful appendage of vulgar convenience is to be suppressed, as ill-suited to its Platonic refinement. As Swift says of Clelia—

> You'd think that so divine a creature
> Felt no necessities of nature.

But such architectural solecisms derogate from the dignity of the art, and convert into a theatrical or romantic dream, that which should embody sound sense and rational invention.

The essential features should be prominently expressed; the nobler portions, the offices, kitchen, the clock, and the stables, should tell their own story. And fiction would be found unnecessary when all these are placed in due subordination and proper character by the artist's hand.

France, until recent times, essentially monarchical and aristocratic, has ever delighted in palaces; and since the reign of Francis I., they have been the most remarkable of Europe. Du Cerceau, Philibert de l'Orme, Mansards, and Blondel, and many able successors, afford us the fullest information on the ichnography adapted to these grades. In conception and design, and in many respects in execution also, the Louvre is the most magnificent palace in the world. Situated in the metropolis, and occupying 32 acres, its galleries, and museums, and its gardens, form the recreation of the people. The paternal monarch invites them into his courts and vestibules, of which he esteems them the best ornaments, the most familiar and acceptable guests at all hours; participating with them his refinements and his delights, they are endeared and elevated, and the palace of the arts and sciences, a part of the entire composition, and ranging in the axis of the first court, forming the chief object from its windows, assure them of the nobleness of his views for their honour and real advantage. The palace itself, the work of centuries, still unfinished, is the great attelier of artists—the field in which they may exercise their genius for centuries to come in their several works—the great harbour in which talent may find protection and employment.

It was for the foundation of such schemes as these, that Francis I. invited Vignola and Serlio, and the painters of the school of Raphael, into France; and for their transmission to posterity, that he encouraged the publication of Cesari Cæsariano's translation of Vitruvius, and the elementary works of Serlio and others, which obtained for him in return the title of the Father of Literature. Nor were his successors inferior in these encouragements, which enabled native artists afterwards to rival the great Italians—for L'Escot was preferred to Serlia, and Perrault to Bernini.

The peculiarity of French orthography is in the high roofs, subdivided into pavilians, affording great effect in composition of various and cumulating forms, aided by their high chimney shafts and dormer windows, and their vast windows below them, suited to the northern climate. Indeed, Philibert de l'Orme, and the architects of his day, have rendered the Italian style homogeneous with the northern climate and circumstances in the happiest manner.

A military people delight in pavilions; each apartment was to represent a tent. So in the Tuileries the line of tents is terminated with two, distinguished by the name of Pavilions de Flore and Marsan. A maritime people delight in their ships: thus the English apartments convey the idea of "between decks," and the larger buildings are often like the man-of-war hulk laid up in ordinary. So in Russia the palaces have the air of barracks; vast and forlorn, they remind the spectator of the plains of Siberia. In Egypt the Troglodite excavation was revealed in the temple palace; in Greece, the log-house in the temple structure: in China, still the tent, in its simplest form.

In the middle ages domestic architecture arose from the monastic structures in single rooms, lighted on either side like our colleges, the chimney shafts issuing from the eaves. The composite house of double rooms was borrowed from the Italians by Francis I., but even there the *degagement* was wanting, and the chamber, ante-chamber, waiting-room, and guard-room, were all passage-rooms. It is in the English palaces that this problem has been best solved.

But the Professor observed, that this digression had led us from the chronology of the art, which terminated with the Roman villa; and we now entered that melancholy period of history, in which all ancient ideas of human enjoyment were absorbed in loftier and more serious aspirations; and the art during the next 1000 years was employed alone in military and ecclesiastical buildings, by means of the Freemasons. The original institution of that order is traced even to the Greeks and Romans. Numa established the first corporations of architects, Collegia Fabrorum, together with the inferior Collegia Artificum. They were invested with a religious character, and rights of framing laws and treaties amongst themselves. They greatly contributed to the increase of the Roman power amongst the barbarians, as have done our own people amongst the North American Indians, with whom an article of treaty on their part, has always been to send a blacksmith amongst them. The Collegia were greatly promoted by the Roman Emperors in the rebuilding of cities, in the aqueducts and public works, and endowed with peculiar privileges, as freedom from taxation, holding councils with closed doors, &c. Victor relates that Hadrian was the first to attach a corps of architects to the Cohorts (about 120, A.D.)—an example which the admirable College for Civil Engineers at Putney, in favour of our colonies, promises to follow with great advantage.

But it was at the termination of the eighth century, that the masons of Como assumed their peculiar form of Freemasonry, raised into importance by the patronage of the commercial and zealous Lombards, in the building of churches and monasteries with new materials; and dispersed after the destruction of that kingdom by Charlemagne, they spread themselves over Europe, obtaining bulls from the Pope, and maintaining peculiar rights and mysteries. Collegia had existed in England; but, destroyed by the ravages of the barbarians, the Freemasons (probably of Como) were invited by Alfred, and after by King Athelstan, who gave them a charter in York (926), the original of which is said to exist still in that ancient city. It cites the Oriental Church, the history of architecture from Adam, with Rabbinical tales of the Building of Babel, the Temple of Solomon; Hieram, the Greeks and Romans, Pythagoras, Euclid, and Vitruvius, are quoted; that St. Albanus (300, A.D.) obtained a charter from King Carausius, with sixteen laws, agreeing with the *corpus juris*, relating to the Corpora or Collegia of ancient Rome. Another precious document preserved to us was written in 1450, under Henry VI., a great patron of architecture, published in the *Gentleman's Magazine* (1753, p. 417).

In 1459 a grand lodge was erected at Ratisbon, of which the architect of Strasbourg cathedral was the grand master. Charters and privileges were added by Maximilian, 1498. In 1717, Sir C. Wren was the grand master in England; but shortly after the ancient fraternity altered its original form and purpose, and became what we now understand by Freemasonry. Wren was then extremely old, and probably unequal to oppose the perversion which then took place; and which, from his known services to the craft, we cannot doubt was contrary to his wishes.

Thus the period of the revival was arrived at, and the Professor explained that in the previous and the present lecture he had devoted the more time to the review of ancient, sacred, and civil architecture, from the persuasion that the art would never again effect similar productions; therefore that antiquity formed that great storehouse from which the architect was to draw his best instructions.

It might be said, that the problem of architectural power and combination had been worked out and solved, that the mastery of the ancients was admitted, and that such works would never again be performed; it would not again become a primary instrument of civilization. The human mind had passed through that stage of its discipline, and had embraced new sciences, engaging the faculties in occupations more advantageous to the improvement and happiness of our species. The intellectual growth to the manhood of our nature, now perhaps attained, would esteem architecture ever a powerful engine in the attainment of the sublime and beautiful, but would probably never again indulge that preponderating regard given to it by the ancients.

The middle ages laboured after the ancient models with many divergencies: in the revival with the muses, the conviction of their pre-eminence was admitted, and their laws and principles were confessed as unalterable. Nothing then was wanted but to revive them, and the zeal with which this object was was immense.

Poggio Bracciolini, in searching for manuscripts, discovered a copy of Vitruvius, "covered with dust and rubbish, in a tower not fit to receive a malefactor," says he, "at the monastery of St. Gal, at Constance." Copies of this happy revelation were spread amongst the learned, until the invention of printing, in 1445, multiplied them amongst the great architects of the day—Brunelleschi, Cæsariano, Bramante, and others. The magnificent Alberti was one of the chief of these, but not finding in Vitruvius sufficient to inform and fire the student's mind, he composed that work which all competent judges have esteemed the most masterly compilation in the art extant. "Seeing," says he (lib. vi.) "that of all antiquity Vitruvius alone has reached us, that such chasms and imperfections appear in his work, that his help is insufficient: his language, too,—Greek to the Romans, and Latin to the Greeks—leaves so much unintelligible, I thought it the duty of an honest and a studious mind to free this science from ruin; though the rehearing without meanness, reducing to a just method, writing in an accurate style, and explaining perspicuously so many various matters—so unequal, so dispersed, and so remote from the common use and knowledge of mankind—certainly required a greater genius and learning than I can pretend to," &c.

But he did not confine himself to the theory of his art; as a scholar, a mathematician, a Platonist, and of a noble family, he associated with all the greatest spirits of his day, and was intimate with the living masters and the progress of their works. Whatever comes from him, therefore, is generous, moral, philosophical, practical, and elevating: he proves himself truly of the order of cavalieros; he mounts you upon his horse, which quickly you find a Pegasus; he raises you above the vulgar cares and labours of this nether world, and in his airy flight he shows you all the kingdoms of the world and their handiworks; and then he sets you down, cheered, instructed, delighted, and exulting in your profession.

The only English edition is that of Leoni, 1755. The spirit of that day deemed art a primary instrument of civilization; it became the boast and the occupation of the little courts of the rival states of Italy; literary societies, discussions, and conversaziones, discovered and refined upon the true principles of poetry and of fine arts; and a Bembo, Sadolet, Annibal Caro, Castiglione, Aretino, and a host of literary stars, all contributed their zeal and means to the æsthetical intelligence of artists. Architecture became the field of poetical imagination: and we have the Ὑπνοτερομαχία, "The sufferings of love in a dream," by the learned friar, Collonna, in which the wonders and delights of the art, and of its theories (full of original and beautiful conception, the source from whence the artists of the day drew continually), are accompanied with the romantic and amorous adventures of blighted love, of which the author was the victim. "The Dream of Poliphilus," printed by Aldus, in 1499, was published in French in 1600, with new plates, engraved from the drawings of Jean Gougeon.

From that period (early in the fifteenth century) to the present day we have a race of able architects in an uninterrupted chain, each adding some new grace or invention to the art, on which their merit and celebrity are founded; all these we now appropriate without appreciating their difficulties, and these progressions; or due acknowledgment to each for the contributions gradually made to our common stock. On the accompanying drawings of some of the great works of those masters, on which our present practice is based, the Professor proceeded to offer some comments. It must be premised that the revival found the art under very different circumstances. The growth of liberty in the middle ages, magnifying the individual, whose house now became his castle, an aristocracy balancing the kingly authority, the increase of commerce, and many other causes, altered the whole face of domestic architecture; it might safely be asserted, that no palace of the solidity of the Strozzi or of Burlington House, ever existed in antiquity. The remains of the most insignificant temples and public buildings are still found, but the absence of any remains of such solid mansions as those throughout the ancient world might be adduced in proof that the domestic architecture of the ancients was slight and ephemeral. The houses of the ancients, like those of the Turks, were of wood and brick, covered with plaster and with paint. Columns, indeed, abounded, but they were moveables, or furniture, the objects of manufacture at the quarries, and of trade. These reflections were sufficient to show, that the features which the architects of the revival, in their endeavour to restore classical architecture, introduced, were new in execution and design, and required a stretch and effort of mind which we do not sufficiently take into account. Those who may be considered the active restorers of architecture are—Brunelleschi, Bramante, Alberti, Peruzzi, Serlio, San Gallo, Michael Angelo, Raphael, San Micheli, Sansovino, Galleazzo Alessi, Vignola, Palladio, Scammozzi, L'Escot, Philibert de l'Orme; many others might be added, but none more remarkable than these. The question occurs, in what particulars were these men great? the answer will always be, that not only were they eminent practitioners, but they advanced their art, and contributed new views and inventions towards its perfection.

The first essays were in imitation of the system observed in the colosseum and the theatre, namely, the column and trabeation in relief, and superposed upon the frieze and arch, and this, in a small scale, formed a crowning order upon the tower on which Brunelleschi raised his dome at Florence. The same difficulties of constructing the trabeation, and of finding stone of sufficient size, and of funds for opening the quarries, which had induced the decline of architecture under Diocletian, occurred in its restoration; and it required the experience of one hundred and fifty years to suspend the disengaged entablature in the ancient manner, with any boldness of scale and projection, as in Perrault's Louvre, about 12 ft. 6 in.

Brunelleschi, in his church of St. Spirito and St. Lorenzo, employed the

orders in good proportion, but these supported arches. The celebrity of Bramante's St. Pietro, in Montorio, doubtless arose, in great measure, from the accomplishment of the trabeated entablature, though the scale was indeed small, only 3 ft. 10 in. from column to column. But the timid application of the classical orders to the middle age buildings, often of large dimensions, gave them rather the character of trinkets hung upon them than of constituent parts of the fabric. Bramante, indeed, made a great step in the palace of Cardinal Wolsey, but the orders are still delicate in low relief, the windows circular-headed (from the difficulty of executing the square trabeated head) with the horizontal entablature above them. The basement, though elegant, has a gothic character, and the crowning cornice has but a small projection; the whole is dry and timid. But Bramante had the merit of inventing the coupled columns, which gave breadth and proportion to the front not otherways attainable. The ancients had left no examples of this disposition—but such were its advantages that it was at once accepted by Raphael and his successors; Perrault used it in the Louvre and Wren in St. Paul's.

Alberti's bold and master mind originated many of those features which his successors knew how to adopt, particularly in his church at Mantua; he gave the hint which M. Angelo followed in St. Peter's, of incorporating the whole height of the interior (not done till then) in one order, and vaulting the ceiling. His church at Rimini bears the stamp of Roman magnificence, quite beyond his age.

Peruzzi was the first to render his orders homogeneous with the structure, and his giving to the entablature of the upper order (especially in the Farnesina) a proportion suited to the entire height of the two, was as beautiful as it was new; it was afterwards adopted by Sansovino in the library at Venice with the greatest effect.

But Peruzzi executed an entablature in the Palace Massimi, and square-headed doors of no mean dimensions (six feet six inches between the capitals); but it was especially in perspective that he made advances far beyond the conception of his day. In other particulars, the merit of Peruzzi is unfolded by Serlio, his pupil, who possessed his collections and published them, through the patronage of Francis I., in the first elementary work on the art written since the revival. The first edition in French is dated Paris, 1545; it was translated into Italian at Venice, 1550, and, by Robert Peake, into English, 1611, under James I.

San Gallo was remarkable for the dignity which he gave to his buildings (especially the Palace Farnese), without the aid of the orders, except in subordinate dimensions, in the windows only, and in the interior court and vestibule. The verticality which is designed and usually conveyed by the orders he communicated to his buildings by rustic quoins, which carry the eye up, and enable it to embrace the whole front. This invention, which appears to be wholly his own, became popular and universal.

The windows, with their small orders, are undoubtedly taken from the Roman tabernaculum, or ornamented niche, so often seen in the baths and in the Pantheon, and was also a new application.

Raphael, as great in architecture as in painting, adopted his master Bramante's invention of coupled columns, as also San Gallo's windows and quoins, and if he did not invent, he employed the balustrade with singular grace and effect—for grace united with strength and nobility, his palace Pandolfini, Caffarelli, and Uggieri are unequalled; indeed, his letters show his enthusiasm for architecture, his profound estimation of the antique, and his ardent aspiration for the restoration of Rome to its antique character and splendour. The backgrounds of his pictures are not less to be regarded as examples than his executed works, being designed with as much care as if they were to have been perpetuated in marble.

M. Angelo distinguished his designs by vastness and singularity, compared with the previous schemes of Raphael, Peruzzi, and San Gallo. We are surprised at his boldness in proposing one order, eight feet in diameter, for the external front, and a corresponding disengaged entablature for an extended portico in the west front—which latter, however, was never attempted. His palace of the Capitol has many merits and peculiarities, one of which, practised in the Laurentian library also, was the sinking his columns in niches.

Vignola has been deservedly regarded as a master of the first merit, and has been hitherto the great authority in the French school, as Palladio has been of the English. His stereotomy, profile, proportion, and composition are admirable; his orders are generally subordinate, often at the top of his buildings—they are never coupled as in Bramante and Raphael, but he reconciles the wide intercolumniation by a panel which gives proportion and sustains the pilaster with excellent effect. This expedient, much followed in Italy and in France, was original with him, as was also his modillion cornice, extending to the frieze, and giving extent and importance to the entablature, proportioned to the whole height of the building, in a better mode than that of Peruzzi. This beautiful invention is recommended without ostentation:—" Questa cornice," says he, " la quale ho mesa piú volte in opera per finimento di facciate, ho conosciuto che riesce molto grata." This cornice was made the termination of the fabric, on which he never permitted a blocking or balustrade. But Vignola was chiefly remarkable for an artifice of composition, which, by subordinating the parts, gave apparent vastness to the whole; his doors and windows are remarkably small, the latter 3 feet 8 inches by 7 feet, only in Capralola—but, being finely proportioned and complete in their members, deceive the spectator into the belief of actual scale. This artifice has been much used by his successors, especially in the upper portions of churches, with good effect, where no means of comparison or admeasurement are offered, just as a man becomes a giant when seen upon a hill and against the clouds.

Sansovino, the Lombardi, and San Michele, Palladio and Scammozzi, formed a school peculiar to Venice, uniting sculpture in the happiest manner with architecture. In the library of Venice, one of the most beautiful buildings of the world, Sansovino adopted two orders, to the upper of which he applied the deep frieze and entablature suited to the *entire* height, after the invention of Peruzzi, the intercolumniations being occupied with the Venetian window, so much employed afterwards in England—these windows having columns doubled transversely in the thickness of the wall, by which an amazing solidity and richness is communicated to the architecture; an arrangement subsequently adopted by Palladio in his town house at Vicenza with admirable effect.

San Michele, chiefly a military architect, and who first gave the gates of cities the character afterwards universal, is remarkable for the energy, richness, and expression given to his works. His employment of the orders and of rustics is exemplary. His gates at Verona, and his palaces in Venice, especially of the Grimani, are masterpieces.

Palladio, by much the most laborious and learned architect of the revival, produced his effects by a happy employment of two orders, the one on a scale comprehending the entire height, the other subordinate, comprehending about two-thirds of that height. This principle had been employed by the ancients in the adjustment of side porticoes to the temple, and in the Propylea of Athens. In this last, the subordinate being 10, the principal is 15; in the Casa del Capitano, it is 10 to 16½; the same in the Basilica; in the Casa Valmarana 10 to 20½. This principle may be regarded as the secret of Palladio's magnificence, just as the subordination of windows and features was of Vignola's. But his employment of the arch in conjunction with the trabeated arrangement adopted from the baths, his classical plans, his mastery over all the features and parts of architecture, cannot be enough studied.

The two volumes on the architecture of Venice, by Cicognara—the single volume of the works of San Michele at Verona, by Albertolli—and the works of Palladio, by Bertotti Scammozzi, should be within the reach of reference to the architect at all times.

The pompous Scamozzi (braggadocio, as Inigo Jones calls him, probably from personal acquaintance, in his visit in 1614,) was a follower of Palladio, though he assumed to be an inventor. He was, however, the first to accomplish a portico, of any size, with a disengaged trabeation, in the church of the Theani. He was chiefly remarkable for the employment of orders above orders in well-studied proportions.

Galeazzo Alessi turned the peculiar locality of Genoa to immense advantage, and was the most active of those who have stamped upon the architecture of Genoa that sumptuous character so original and exemplary. This architect was in frequent competition with Palladio and Vignola at Brescia, Bologna, and other cities.

L'Escot and Philibert de l'Orme, in France, laboured with great advantage on the materials thus offered by the great masters of Italy; and they are chiefly remarkable for their adaptation of their inventions to the requirements of a northern climate, in large windows, chimney shafts, high roofs, &c.

The student will add many more peculiarities and titles of merit to the great masters of the revival from the hints here offered.

AN ARCHITECTURAL DOCTOR, AND ARCHITECTURAL IDLERS.

Sir—Whatever may be the merit of Mr. Gwilt's work, as one of elementary and practical instruction—and he must have been ingenious, indeed, to have got up so bulky a volume without at the same time bringing together information, new as such to many, if not to all—whatever merit, I repeat, it may so have, the intolerance and illiberality not only betrayed in it, but in many places openly expressed, are not very creditable to him, nor likely to recommend his book. The most that can be said in his favour is, that he does not stoop to flatter, nor has even attempted to conciliate the good opinion of, those whose opinion is likely to have some influence in stamping the character of his " Encyclopædia." It is to be hoped that the bulk of the profession—at any rate those who follow it as a liberal* art, do not at all agree with him in his "bow-wow" depreciation of a class of persons to whose labours in the study of Gothic architecture we are greatly indebted, and professional men themselves not least of all. It may be fairly questioned if that style of the art would have been revived among us at all, but for the diligence of extra-professional students, and the attention directed to it by their writings.

It might be thought that, if not disinterested generosity, at least a sort of enlightened and generous selfishness would induce architects to encourage as much as possible a taste for the study of their art—and without some study, a taste for the art itself cannot be acquired—and to aid in removing the prejudices which deter persons in general from approaching it, under the false notion of its being entirely a practical one,

mechanical, dry, and repulsive. Whether any of his brother architects will now side with Mr. Gwilt, remains to be seen; but in my own opinion they have very little cause to congratulate themselves upon having a champion in their ranks, who would show his prowess by hewing down, and putting *hors de combat*, all the volunteers engaged in the same cause. Much liberality I did not expect from Mr. Gwilt, but I certainly did suppose that he would exercise a little more discretion than he has done. I did not, for instance, imagine that he would allow his antipathy to German architecture to prevail so far, as to give no account of any of the numerous fine buildings erected in that country during the last 30 years; and as not to applaud the zeal with which architecture is there cultivated, if he could not say much in favour of the taste displayed in it. Had he done so—and the same with regard to other countries, those chapters of his work might have been made to contain a great deal of quite fresh and valuable information. The reason assigned by him for not doing so, is a most flimsy and childish one—perfectly ridiculous; for according to that, there ought to be no such thing as criticism on contemporary works at all; nor ought any to have yet appeared relative to those of a Thorwaldsen, a Cornelius, and other great living masters in their respective arts. Besides, he might have executed that part of his task very *innocently*, and without giving the slightest umbrage to any one, by abstaining altogether from criticism and comment, and confining himself to description and mere matter-of-fact information. At present, his apology for passing over altogether what he was conscious would naturally be looked for, sounds too much like the fox's—"the grapes are sour." The real reason, there can be very little doubt, was his inability to make the necessary research, and collect materials for that part of his work, wherefore he would have done well to obtain assistance for it. Considering his avowed and unqualified dislike, or I might say, hatred of modern German architecture, it is not very surprising that he should not have referred us to any of its chief productions, lest the bare mention of them should be mistaken for approbation. Yet neither does modern Italian receive better treatment from him, for he says nothing of what has been done in that country, within the present or even the last century, excepting the palace at Caserta. There is not a syllable relative to such architects as Calderari, Temanza, Selva, Piermarini, Cagnola, Niccolini, and a great many others, whose works display quite as much ability and taste as some of those which he most highly praises. Nay, though he expresses so very high an opinion of modern French architecture generally, it is only in general terms, without either describing any thing of the kind, or showing it in a wood-cut. In fact, he has not introduced any fresh subjects among his "illustrations;" and of his "more than 1000 engravings on wood," the greater part are mere diagrams, and the rest of very ordinary character. What will ultimately be *that* of his "Encyclopædia" itself, may easily be guessed, for most assuredly it will not obtain a very flattering one either from students of Gothic, or admirers of German architecture, both of whom will not only be disappointed in it, but offended also, more particularly the former, since they are by no means likely to relish the insolently sneering and contemptuous tone in which Mr. G. speaks of the "literary idlers, especially at the universities," who amuse themselves with inquiring into the history of Gothic architecture; which censure, we must suppose, extended by him also to such publications as those by Parker, and Bloxam, their object being to aid, encourage, and promote the study of it, not at the universities alone, but all over the kingdom. But the popular current against which Mr. Gwilt swims, may overwhelm both him and his book; therefore, his opinions may do no great harm after all. What is chiefly to be regretted is, that his "Encyclopædia" is likely to stand for some time in the way of any better publication of a similar nature, because, though there is ample room for one, in one sense, the market for it is, or will be thought to be, pre-occupied.

I remain,

Yours, &c.,

"A LITERARY IDLER."

ON THE STRENGTH OF BEAMS.

SIR—One of the greatest advantages which the practical man has over the theoretical, is that of being able to discover any *great* error in a design by mere inspection; this facility in discovering serious mistakes at a "*coup d'œil*" is only acquired by men of great practical skill and long experience, and is a faculty too frequently dearly bought by many failures; the practical man, in forming a design for a bridge or any mechanical structure, seldom uses anything besides a scale and pencil; he rarely commits any great error, but also he is rarely exactly right; on the contrary, certain data being given to the theoretical man, he enters into calculations mostly always long and intricate, and forms his design according to the dimensions obtained from his results; he frequently commits a mistake in his calculations, omits the consideration of some modifying circumstances, and thus his design is faulty, and frequently is only discovered to be bad when the structure falls to pieces; even then he will certainly lay the blame on the builder, like a celebrated French engineer who, being told that a large bridge built according to his design had given way on the striking of the centering, would not believe it, saying, "Impossible, I calculated its dimensions to the greatest nicety."

The sensible engineer will combine theory and practice, and giving to neither undue preponderance, will certainly, *ceteris paribus*, produce the most perfect design; he will neither trust too much to the eye nor rely implicitly on his calculations, and thus he will avoid such a serious error as that which I committed, in my answer to the question on the strength of beams, proposed for solution by "Concrete," and which appeared in your *Journal* of last month; if I had constructed the result obtained by algebra and made a sketch of the beam corresponding to that answer, in short, if I had followed the advice given above of not trusting too much to your calculations, but correcting them by the eye, I should at once have perceived my gross mistake, viz., that of multiplying, instead of dividing, the momenta of the weights by the internal leverage of any point, in order to find the counterbalancing weight.

By correcting the error myself, I shall prevent much useless discussion and comment from your Argus-eyed readers; at the same time I shall briefly explain what I conceive to be the real solution of the question. I stated in my letter of last month, that the true and best form to give to the beam is the parabolic; this being however deduced from erroneous calculations, must be altered, and a result much more simple and satisfactory will ensue by modifying the equations in one or two steps, dividing, in place of multiplying, the momenta of the weights by the lengths of the internal segments at any point between the supports, in order to find the equivalent weight there. For the purpose of rendering my explanation more clear, and making the action of the weights on a beam so circumstanced, more intelligible, I add a sketch of the form it will assume before it attains the point



of fracture. N', M', M, N, is the beam resting on the supports M', M; the distance between these is 6 times that of the points of support (M', M,) from the extremities N', N, to which the equal weights W', W, are applied, to find the best form of the beam between the points of support. On first applying the weights, the part between the supports cambers, as represented in the sketch by the dotted line, and assumes a circular form, becoming more flattened at the centre as it approaches the point of fracture, and ultimately breaks at or about the points c, c_1. I am indebted to a friend, on whose accuracy I can depend, for the account of the experiments from which this explantion has been deduced; you will observe how precisely it agrees with Concrete's statement of the points of fracture as deduced from his own experiments; I must here apologise to him for having cast a doubt on their accuracy; I could not account how the beams could give way at these points; which more particularly made me suspect some error, is his statement that the bar of iron broke in *two* points. The experiments I brought forward in support of my explanation in your *Journal* of last month, were conducted on such a small scale that I am not in the least astonished at the fact of the model yielding in the centre. It appears from the above sketch how the beam may remain in a very curved position without breaking; the leverage of the weights decreasing as the beam approaches the point of fracture. In the following investigation, I shall however omit the deflection of the beam and its weight. What then is the weight which, placed at any point (P) between the supports, will balance the two external weights, and what is the effect of its strain at that point?

From the principle of the lever, it is found equal to W. MN ✕

$\frac{MP + M'P}{MP \times M'P}$; but the strain of any weight at the point P, as is proved in all works on mechanics, is expressed by the product of this weight, and the fraction $\frac{MP \times M'P}{MP + M'P}$, and consequently in this case by W × MN; that is the momentum of the external weight, a constant quantity, but since the strength of the beam at any point is proportional to the breadth multiplied by the square of the depth, the breadth being the same, it ensues that the beam should be rectangular. If the weight of the beam was taken into consideration, it would appear that the depth of the beam should slightly increase from the centre to the supports; and it is because this weight acts with greater effect at the centre that, in the experiments alluded to above, the beam broke near the supports. In practice, therefore, the beam should be made *rectangular*, unless its weight be considerable, in which case its depth should slightly increase from the centre to the supports, according to a law easily deduced by introducing the action of its weight at any point in the above equations.

The strain at any point between the supports is W. MN, and at any point outside the supports, W multiplied by the distance of the point from the extremity. The strain is therefore less externally than internally.

You would greatly oblige me by inserting this letter in your next number.

I remain, Sir,
Your obedient,
T. F——x.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

Annual Meeting, Jan. 17, 1843.

ANNUAL REPORT.

This report contains a reference to the proceedings and principal papers read before the Institution last session, and which have been reported in the *Journal* of last year; likewise the receipts and expenditure of the past year, and the following obituary:—

We have to regret the decease of the Right Honourable Lord Congleton, Mr. Samuel Seaward, Mr. Benjamin Hick, Mr. Charles Collinge, Mr. W. D. Anderson, Mr. John Smeaton, and Captain Foster, Bombay Engineers.

LORD CONGLETON.—Sir Henry Parnell was born in the year 1776. After the usual routine of university education he entered early upon a parliamentary career as member for Queen's County, and became distinguished for his steady industry and application to business; his speeches abounded with facts and calculations, and in many political as well as financial questions he took a prominent part. In 1828 he was appointed chairman of the Finance Committee; subsequently he became Secretary-at-War and a member of the Privy Council; in 1835 he succeeded Lord Lowther in the office of Treasurer of the Navy, with which were consolidated the duties of Paymaster-General of the Forces and Treasurer of the Ordnance, which combined office he held until his elevation to the peerage in 1841 as Lord Congleton of Congleton, in Cheshire. These public duties did not prevent him from filling numerous private offices, among which must be principally noticed that of chairman of the Commissioners of the Holyhead Road. This post naturally created an intimacy between him and our first president (Mr. Telford), which was only interrupted by the death of the latter. The active mind of Lord Congleton being thus directed to engineering pursuits, he cultivated the society of other civil engineers, and became an honorary member of this Institution in 1833; his Treatise on the Construction of Roads, and his plan (adopted by the Post-office) for improving the construction of mail coaches, show that his acquirements in the practical details of professional subjects were not superficial. He published also several works on finance, banking, and the currency, besides pamphlets on Catholic Emancipation and other political subjects. The decease of his Lordship took place in the sixty-sixth year of his age, respected as a public character for his attainments, his general consistency, and his great industry, and regretted by a large circle of private friends.

MR. SAMUEL SEAWARD, F. R. S., &c., was born at Lambeth in the year 1800, and at the age of fourteen years he entered the service of the East India Company as a midshipman: after his second voyage to Bombay and China he relinquished a naval career, and was placed by his brother as an apprentice with the late Mr. Henry Maudslay, in whose establishment he had the best opportunities of acquiring a practical knowledge of mechanics and engineering; of these opportunities he carefully availed himself, and always cherished a grateful recollection of his instructor. After passing about five years with Mr. Maudslay, he entered the service of Messrs. Taylor and Martineau, whence he proceeded to Cornwall, and assisted, under the direction of Mr. Arthur Woolf, in the erection of several large pumping engines; he then undertook the superintendence of part of the works of Mr. Harvey, at the Hayle Foundry, where he had the advantage of the instructions of Mr. Richard Trevithick. In the year 1825 he returned from Cornwall and joined his brother, Mr. John Seaward, in the Canal Iron-works, Limehouse, as manufacturers of marine and other steam engines, as well as of general machinery. The attention devoted by Mr. Seaward to the construction of marine engines particularly, and the successful adaptation of the "direct action" engines[1] (which were, it is believed, first introduced by Mr. Gutzmer, of Leith, on board the *Tourist* steamer), are well known in the profession. His ingenuity and mechanical talents are manifested in all the works undertaken by the firm to which he belonged, and by several scientific pamphlets which he published. He joined the Institution in the year 1828, and became subsequently an active and useful member of council, and our Transactions are indebted to him for a memoir "On the application of Auxiliary Steam Power to sailing vessels on long Voyages." Snatched from among us at the early age of forty-two years, the profession has lost an intelligent and zealous member, and his private friends a worthy and estimable man.

MR. BENJAMIN HICK was born at Leeds in the year 1790, and was brought up as a practical engineer in the establishment of Messrs. Fenton and Murray, by whom at an early age he was intrusted with the superintendence and erection of several large engines, &c., and he was eventually offered a partnership in their works; this he declined, and in 1810 engaged with Mr. Rothwell in the Union Foundry at Bolton, of which he was the managing partner; and in 1833 he established the Soho Foundry, now carried on by his sons in that town. His attention was directed to almost all branches of mechanics, and the ingenuity displayed in his inventions and improvements is generally acknowledged: some of his improvements have become public property without being claimed by him, or its being known from what source they emanated. He became a member of the Institution in the year 1824, and although the distance of his residence precluded his frequent attendance at the meetings, he was a liberal contributor to the collection of models, &c. His good taste, his integrity of character, the encouragement which he extended to talent of all kinds, and the assistance given by him to all public improvements, obtained for him considerable influence in the town of Bolton, where his loss will be much felt.

MR CHARLES COLLINGE was born in the year 1792, and being engaged from an early age in mechanical pursuits, he eagerly embraced the proposition of your vice-president, Mr. Henry Robinson Palmer, to unite with him and a few more young men[2] in forming a society for mutual improvement, by discussing scientific subjects; from this commencement, in the year 1818, has arisen the Institution of Civil Engineers, which now numbers five hundred and twenty-five members of all classes. Mr. Collinge continued, through all the stages of its progress, an useful and active member; he took his share of the duties as a member of council, and filled the other offices of the Institution with readiness, and his attendance at the meetings was very constant.

MR. W. D. ANDERSON was a pupil of our first president, Mr. Telford, after whose decease he travelled in Italy, whence he sent to the Institution a series of drawings of the Ponte Santa Trinita at Florence. On his return he was engaged under Mr. W. Anderson (his father), the engineer of the Grand Junction Water-works, on several surveys and other works. He then gave plans for, and was appointed engineer to, the Exeter Water-works, which situation he resigned in 1837, in order to become engineer to the corporation of Newcastle-on-Tyne, where he constructed some important works. Ill health obliged him to resign this latter appointment in the year 1841, and his decease took place during the last summer.

MR. JOHN SMEATON and Captain R. FOSTER, Bombay Engineers, had only been elected during the past session, and owing to the sudden decease of the former, and the shattered health of the latter, consequent on a lengthened residence in the East Indies, they had scarcely ever been able to attend the meetings of the Institution.

ADDRESS OF THE PRESIDENT.

Before I resign this chair I have to perform the pleasing duty of thanking you for your attention to the Institution, which has enabled your Council to present to you the satisfactory Report that has just been read, and has rendered the discharge of my duty so agreeable. I take advantage of the opportunity thus afforded me, to refer to some points which may not be considered strictly within the scope of the Report of the Council.

Honorary Members.—The Report has informed you of a considerable addition to the list of Honorary Members, by the election of several distinguished individuals.—The following is a list of the Honorary Members referred to:—Field Marshal the Duke of Wellington; the Duke of Buccleuch and Queensberry; the Marquis of Northampton, President of the Royal Society: the Lord Chancellor Lyndhurst; Lord Brougham and Vaux; Sir Robert Peel, Bart., First Lord of the Treasury; Charles Shaw Lefevre, Speaker of the House of Commons; Professor Airy; the Rev. Dr. Buckland; and the Rev. Dr. Robinson, of Armagh. These have been elected, not on account of their rank alone, but because with rank, they hold, or have held, high stations, or have been placed in situations in which they have shown

[1] The engines of the *Gorgon*, the first of a numerous class of Government steamers fitted with that kind of engine, were built at the Canal Iron-works.

[2] Messrs. H. R. Palmer, J. Field, W. Maudslay, J. Jones, C. Collinge, and J. Ashwell.

their desire to advance the sciences or arts connected with Civil Engineering; or because they are themselves eminent as men of science and learning. None of them were proposed until they had, like all other candidates for election, expressed their desire to become Members; and in many instances their wishes have been communicated in a manner highly complimentary to the Institution and to its objects. Indeed it is impossible that public men, who have held the highest offices, possessing only the tithe of the understanding of a Wellington, a Brougham, a Lyndhurst, or a Peel, can be indifferent to the growing importance of engineering to the welfare of this country, or not aware that the greatness, I may, perhaps, be justified in saying, and even the existence of the nation, mainly depend on it. It has been said that the steam engine, rendered powerful and practicable by Watt, fought the battles and gained the victories of the last great war; that by it the mines were drained, and the ores and coal raised, which, when applied to Arkwright's and other improvements, multiplied in effect the power of the country, reducing the price of mechanical labour a hundred-fold, and enabling us to supply foreigners with our manufactures, for which they returned us the sinews of war; and that, hence, notwithstanding an expense, beyond all precedent, continued for a quarter of a century, the country, even if the increase to the national debt were deducted, was richer as well as more powerful and more populous at the end than at the beginning of the war. In this there is much truth, but the effect being indirect is not so obvious. In the late Syrian and Chinese wars, however, there could be no doubt. In both cases the work was done chiefly by steam ships of war; and it could not have been done so quickly or so effectually in any other known way. The steam engine, therefore, may now be considered the great power in war as well as in peace; and hence, in another light, the immense importance of the objects of this Institution, when it appears that the long-boasted wooden walls of Old England will henceforth be comparatively inefficient without the co-operation of steam. I do not mean by this to express any opinion of the justice or policy of the late wars—the most glorious part of them was, in my opinion, their termination. My object is to show why the lately elected honorary members have naturally been desirous of becoming so; why we have elected them, and why we may expect them to take an interest in our proceedings and our progress. But there are other considerations more congenial to our civil position in which the individuals who have not written and published scientific works are to be regarded as worthy of the membership.

Sir Robert Peel, now at the head of the government of this country, has not been unmindful that to the application, by his enterprising parent, of the discoveries of Watt and Arkwright he owes the position and education which started him in public life. At the public meeting in 1824, for erecting a monument to Watt, Sir Robert, then Mr. Secretary Peel, said, "that he belonged to that very numerous class of persons who had derived a direct personal benefit from the important discoveries of Watt, and he acknowledged with satisfaction and pride that he was one of those who derived all that they possess from the honest industry of others." His connexion with us is therefore natural: and by evincing his desire to promote science and the useful as well as the fine arts, he has proved, and I am sure will continue to prove, himself a useful as well as an ornamental member.

The Duke of Wellington, in being, while in office, mainly instrumental in recommending the means for proceeding with the Thames Tunnel, and for completing the approaches to London Bridge (one of the greatest metropolitan improvements), considered that he only did his duty; but Sir Mark Isambard Brunel, and Mr. Jones (Chairman of the London Bridge Committee), consider that to his Grace is mainly due the merit of these great works; and that as Lord Warden of the Cinque Ports, he has always taken a lively interest in the works of Dover Harbour and other improvements upon the coast, I can bear witness, as well as to his knowledge of works of civil engineering, which he has lost no opportunity of cultivating. His Grace's reply to a question by me, as to how he came to know so much of the different plans of sluices for draining, &c., was, that when with the army in Holland and Belgium he had plenty of time to ride round the country and to examine them.

The Duke of Buccleuch has, in being the liberal President of the College of Civil Engineers, shown his desire to advance the profession; and in the formation of mines, railways, roads, bridges, and piers, upon his extensive estates, he gives the best practical illustration of his taste for works of engineering, and his wish to promote the objects of this Institution.

Earl De Grey, as President of the Institute of British Architects, himself in taste an architect, and aware of the close connexion between architecture and engineering, has abundantly shown the interest he feels for our success and progress.

The Marquis of Northampton, as President of the Royal Society, would have had sufficient passport for membership, even if his zeal for science, particularly geology, which we all agree with Dr. Buckland to be intimately connected with our profession, were not known. At the last anniversary of the Royal Society, his Lordship, in proposing as a toast the success of this Institution, referred in very flattering terms to its importance and future prospects.

The Speaker of the House of Commons, Mr. Shaw Lefevre, has been a fellow-labourer with our associate, Mr. Handley, in the application of engineering to agriculture,—not only in the drainage of great districts, but in machinery of all kinds, from the steam plough downwards.—Our member, Mr. Parkes, could fill up a long list of Mr. Shaw Lefevre's exertions in this way. As a Commissioner, *ex officio*, of many of the most important public works, I have witnessed his attention to details which, unless he were fond of engineering, he would not think of, even if he had more leisure than the onerous duties of Speaker of the House of Commons allow him.

I might proceed to remark on the other recently elected honorary members, but they are so well known, and have by their writings shown themselves so qualified, that to do so would be an unnecessary occupation of your time.

The late Mr. Ewart.—Having referred to the subject of our steam fleet, I may mention that, until the year 1835, there was no chief engineer and inspector of machinery for the navy, and that Mr. Peter Ewart, who died during the last summer, first held that office. As he was not a member of the Institution he is not noticed in the report of the Council; but the situation he held, and his talents, will, I trust, be considered sufficient to make acceptable a short notice of some facts respecting him.

Mr. Ewart was born on the 14th of May 1767, at Troquaire Manse, in the county of Dumfries. His father, and two or three generations before him, were clergymen of the church of Scotland. Peter was the youngest of a family of ten children (six sons and four daughters). The father's care was divided between the duties of his parish, his private studies, and the early education of his family, which he superintended,—the result proves how successfully; two of his sons having been well known as among the most eminent merchants in Liverpool, and a third as Envoy of this country at the Court of Berlin, where he died at the early age of 32 years. At nine years of age Peter was sent to the Dumfries parish day-school, where he had the benefit of good masters, particularly of Dr. Dinwiddie, an excellent mathematical teacher. At this period his natural turn for mechanics showed itself. His hours of recreation were spent in the shop of a watch and clock maker (named Crocket), which lay between the school and his home; and so well did he profit by what he saw there, that at the age of twelve he had, from materials which he had collected, made and finished a clock that performed well, and was the most interesting piece of furniture in his bed-room. In his fifteenth year he went to Edinburgh and attended a course of lectures, probably those of Professors Robinson and Playfair, as these distinguished philosophers were subsequently on the most intimate terms with Ewart. John Rennie, the late eminent engineer, had a short time before this begun business as a millwright in East Lothian, and on Ewart's leaving Edinburgh he was sent to Rennie. Ewart told me that he was Rennie's first apprentice; that Rennie had one journeyman; and that one of the jobs of the trio was the construction of a small water-mill (the Knows Mill), upon Phantassie farm, for which a shed was lent by Rennie's elder brother George, who afterwards stood as high as an agriculturist as his brother John did as an engineer. He described to me the scene that took place on the day this mill was started, when, inspired by the success of his first work, his master foretold, to the astonishment of his journeyman and apprentice, his own future greatness.

The facts that the celebrated James Watt was about this time employed in the erection of his steam-engine to work the Albion Mills, which stood at the south-east angle of Blackfriars Bridge, now Albion-place, that he applied to Professor Robinson to recommend to him an intelligent well-educated mechanic to superintend the mill-work, and that Robinson fortunately recommended Rennie, the Lothian millwright, who had distinguished himself in his class, are well known. And here I would call the attention of my young friends to the illustration which Robinson's recommendation, as well as Rennie's success, affords, that a practical knowledge of millwrighting is one of the best, if not the very best, foundation for engineering. Soon after Rennie's arrival in London he sent for his apprentice Ewart to assist him in the erection of the mills,—a proof of his opinion and his friendship. Ewart followed his master. How well he had calculated the expense of the journey may be collected from the fact that the last penny he had was paid as toll for passing Blackfriars Bridge to enable him to reach the mill. For four years, 1784 to 1788, Ewart worked as a millwright at these mills, whence he was sent by Mr. Rennie to Soho, to construct a water-wheel for Mr. Boulton's rolling-mill, and was afterwards taken into the service of Boulton and Watt, to erect their steam-engines. There he had ample scope for his abilities, and the advantage of Watt as his friend; this friendship terminated only with Watt's life, and was continued by the present Mr. Watt, whom I have often heard speak with the greatest respect of Ewart's abilities and excellent qualities.

In 1791 he was sent by Boulton and Watt to fix one of their engines upon the cloth-works of Benjamin Gott and Co., Leeds. Mr. Gott, who was then a young man, and became afterwards on the most public-spirited and liberal, as well as greatest manufacturers in this country, was just the person to appreciate Ewart's qualities; the engine superintendent became his friend, and that friendship remained firm and unchanged for nearly half a century. I have heard Mr. Gott speak in the highest terms of Ewart. The following anecdote, told me by Mr. Gott, proves that others well able to judge entertained the same opinion. A gentleman speaking of Ewart at Gott's table, said he had met with but few better practical mechanics than Ewart. "You have been a fortunate man," said Professor Playfair, who was of the party, "for I have never met with one." In 1795 and 1796 he assisted the present Mr. Watt in planning the buildings and works of the Soho foundry, shortly after which, he quitted engineering as a profession, and became a manufacturer, first at Stockport with Mr. Oldknow, then shortly after in Manchester with Mr. Gregg, and afterwards he took a cotton

mill on his own account. His bias being always so much towards mechanics, it is not improbable that his idea was that he could make great improvements in the cotton machinery, and that this led him to engage in the business of a manufacturer.

Ewart remained in Manchester in constant association with Dr. Dalton, Dr. Henry, Mr. Kennedy, and other eminent men, until 1835, when he was recommended by the present Mr. Watt to the Admiralty as a proper person to fill the situation which he held until the time of his decease, on the 15th September, 1842, then in his 76th year. His health had been delicate for some time; but the immediate cause of his death was a blow from the end of a chain which broke when he was standing near it in the Dock Yard at Woolwich. Notwithstanding the long interval between his quitting the practice of engineering and his returning to it, and notwithstanding his age (68 years) when he undertook the office, he gave, so far as I have ever heard at the Admiralty or elsewhere, great satisfaction. The professional responsibility, in his own department, of the steam machinery of the British navy rested upon him, and how well he acquitted himself is proved by the results in China and Syria, and in almost every other quarter of the globe.

Mr. Ewart's change of employment for so long a period of his life has caused his name and character to be less generally known than they deserved to be. Like Playfair, I may say that I never met with a man who had so general an acquaintance with engineers and mechanical men of his own time as Ewart had, but he was not easily brought out. I have often pressed him to record in some way his great store of anecdotes and interesting facts, but my doing so was in vain. To write or even to speak on matters in which he had taken an active part appeared painful to him, and was never done when with more than one or two friends. His knowledge of machines, and particularly of the principles of the steam engine, was very intimate. His admiration of Watt, and his practice at Soho, inclined him to view with some degree of scepticism any innovation in the engine, which he considered to have been almost perfected by his great master; and, for the public situation which he held, this prejudice was probably useful, for the war steamers in active service are not those in which new schemes should first be tried.

Ewart was a warm and persevering friend to merit. My friend, Mr. Hartley, engineer to the Liverpool Docks, considers that he owes his appointment chiefly to Ewart's exertions in his behalf, and Ewart was ever afterwards ready to assist Mr. Hartley with his scientific opinion. Mr. Hartley is conscious of the advantage he derived from it, and considers that by Ewart's death he has lost his best and ablest friend and counsellor. Sir Edward Parry (the comptroller of steam machinery to the navy,) in a note I have lately received from him, states, that "after more than five years' constant and intimate acquaintance with Mr. Ewart, he must declare that he never met with a man of sounder judgment, more amiable feelings, or stricter integrity of purpose; and that he felt he had, at his decease, lost an esteemed friend, as well as a valuable coadjutor in the public service." Sir Edward's note then refers to the late results of the war in Syria, and still later in China, in which he says, "the mighty power of steam played so decisive a part, that these wars, humanly speaking, may be said to have been entirely terminated by steam."

I will close this subject with an extract of a letter, dated in 1793, from Dr. Currie of Liverpool (the elegant biographer and editor of Burns), to Mr. Wilberforce. The letter is given in the first volume of Wilberforce's correspondence. It appears by the description that at that time the distress of the cotton manufacturers was greater than even anything of recent date; that the workmen were in a starving state; and that Ewart, the partner of Oldknow, went to Liverpool to represent the extreme case, and endeavour to obtain the attention of ministers through the members. He had a meeting with Dr. Currie, who writes thus to Wilberforce in order to increase his attention to the statement of the case.

"(Ewart) is no common character; he was with Boulton and Watt as superintendent of machinery, and has an extraordinary degree of the most useful knowledge of every kind, and in a word is one of the first young men I ever knew. These qualities recommended him to the notice of the manufacturers, among whom he exercised his profession of mechanic and engineer. He had offers of partnership from the first houses there, and was actually taken into the house of Mr. Oldknow (of Stockport), at that time the first establishment in Lancashire. Mr. Oldknow was the original fabricator of muslin in this country, and a man of first-rate character."

Mr. Cotton.—Having referred to the countenance received from distinguished noblemen, I must not omit also to say how proud I am of the communications and presents we have received from my excellent friend Mr. Cotton. Ewart was not more devoted to Watt than Cotton was to his late friend Huddart, whose portrait is, through Mr. Turner's kindness, before me. Watt and Huddart were indeed kindred spirits, I have often seen them together, and at the time and since I have often thought that never were two men better paired in person and bearing as well as in mind. Mr. Cotton was the friend of both. Being governor of the Bank of England, and therefore filling the highest office in the greatest corporation in the world, he has given us very decided marks of the estimation in which he holds us. Following his friend Huddart in the march of mechanical improvements, Mr. Cotton has invented a very beautiful machine for weighing gold coin: it is now used at the Bank, and from his uniform attention we may expect soon to have it brought under our notice.

Thames Tunnel.—Among many engineering works of which this country is possessed, none has, during its execution, attracted so much public notice as the Thames Tunnel, and this even more in foreign countries than in England. In October 1842 the shield reached the shaft on the Middlesex side; and we may therefore congratulate Sir Mark Isambard Brunel in having, so far as the great engineering work goes, completed the tunnel, and accomplished the great wish of his heart. With the amazement with which foreigners consider the abstract notion of a tunnel under the Thames, we in this country of mines and tunnels do not sympathize. We know that if the tunnel had been through the London clay or the chalk, there would have been little difficulty; but this was not the case; the strata were of the worst kind, often entirely silt and quick-sand, which were forced through the smallest apertures. At these times the iron of the shield, little more than an inch in thickness, was the only division between the tunnel and the Thames. On three occasions this ever-watchful enemy succeeded. The second irruption, which took place on the 11th January, 1828, was the most serious, as then not only was the whole tunnel in possession of the Thames, but the shield, the invention of Brunel, and by which alone so much could have been done, was, as if in revenge, seriously damaged by the invader, and the tunnel was left nearly filled with mud. Nine-tenths of those who professed to know anything of the subject, then considered the case desperate, and the works were indeed abandoned until the year 1836; but never, at least since the time of the Roman engineers, who confined him to his present width by their artificial embankments, had Father Thames so determined a general to oppose him as Father Brunel. Armed with a new and more powerful shield, in design a masterpiece of ingenuity and contrivance, and executed in the best manner by Messrs. Rennie, the engineer and his companions renewed the attack; and although twice afterwards beaten back and obliged to surrender possession, he has at last succeeded, and may now, I think, bid defiance to the enemy. It was my duty, as the engineer consulted by the treasury, to visit the works on several occasions, and I can therefore certify to the difficulties and indomitable courage of our veteran member, which never failed him, for the notes which he despatched to four individuals (of whom I was one) on the occasion of irruptions, read as if he were rather pleased that the event had taken place; as if he had gained a victory rather than suffered a defeat; resembling in this respect the bulletins from other great generals, who have not however always been so successful in recovering their misfortunes. The difference might be that Sir Isambard had a Wellington, not to oppose, but to aid him. But, seriously, looking at the Thames tunnel entirely in an engineering point of view, we cannot but be proud of the work, and pleased to have the opportunity of congratulating Sir Isambard Brunel on the result of sixteen years (eight of which he spent on the spot) of hard mental and bodily labour. I know no other man who would have so worked, or if he had, could have so succeeded. France, his native country, has reason to be proud of him, as England, his adopted country, is. To Mr. Armstrong, Mr. I. K. Brunel, Mr. Beamish, and Mr. (now Professor) Gordon and Mr. Page, who were successively the assistant engineers, great credit is due; and Sir Isambard has always spoken with satisfaction of their services and of the perseverance and courage of the men, many of whom stood by him in his greatest need as if the merit were to be theirs.

Electric Telegraph.—Having said thus much on the Tunnel, I am induced not to pass over unnoticed Professor Wheatstone's application of electricity for telegraphic and other purposes, considering it strictly within our province, not only from its nature, but its application to railroads and similar purposes. And as respects utility (if there be use in despatch), we need have no apprehension on that account. The velocity of Wheatstone's messenger has reached a maximum, which can safely be said of but few human things, and we ought to be satisfied, as we know that the speed is about 170,000 miles per second—that therefore a message could go to Bristol or Birmingham in $\frac{1}{1100}$ of a second, or round the globe, if wires could be laid for its travelling upon, in one-sixth of a second. The messages upon the Blackwall railway, upon part of the Great Western railway, and some other railways, are carried at this extraordinary rate. The bells in the House of Commons are rung by it, and its uses are extending. Its superiority for telegraphing appears obvious. Professor Wheatstone informed me some years since that by his machine for measuring the velocity he made 10,000,000 of miles per minute. I had named $10\frac{1}{2}$ millions, being the velocity of light—my opinion, erroneous perhaps, having long been, that solar light is a modification of electricity, an hypothesis that seems to dispense with the necessity for the doctrine of latent light, which Professor Moser has introduced to account for his late elegant discoveries; but this is too wide a field to enter on now. My object is to express how much I think the profession and the country are indebted to my highly gifted friend, who has entered upon his important labours with a zeal worthy of the cause, and a success that holds out the hope of ample reward; for I feel convinced, that great as the recent discoveries in electricity or photography are, they are but an earnest of what is to come; that riches are to be extracted from these recently opened mines, of which we have not at present the most distant notion. Unfortunately miners cannot work without tools, and they cannot always, from their own resources, command them. France has, by rewarding Daguerre, and giving, so far as she could give, his inventions as a free gift to the world, set a noble example. I have not heard that Wheatstone has had any public aid in prosecuting his researches; but with our own honorary member as premier, we may depend that the government of this great country will not be indifferent to a matter which involves so much of practical utility and at the same time national glory.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

Feb. 6.—William Tite, Esq., in the chair.

Mr. Morris read a paper on *Ripon Cathedral*.

Mr. Papworth read a paper explaining the method adopted by him in 1829, to confine the lateral walls, then inclining outward of Trinity church, on Clapham-common. Upon a survey of the building, it was discovered that the brick footings of the walls of the church and tower, were built upon a continuous 4 in. yellow fir planking, containing much resinous matter, and abounding with large knots. In the first instance the trenches were not dug perfectly level, and the bottom course of brickwork was laid dry, thence much of the trench was in winter, subject to wet, and at all times to some moisture. In some parts, particularly the north west angle of the tower, and west staircase, the timber was probably never dry . the nature of gravel, (absorbing moisture freely) upon which the walls were built, of course admits damp air, and the timber is proportionably subject to the decay common to wood when so circumstanced.

The footings were first examined from the vaults, when the timber beneath the brickwork was found to be in such a pulpy state generally, excepting at the knots and closely adjacent fibres, that the walls, both of church and tower might really be said entirely to depend on the latter for support; with the addition of the adhesion of the materials and the strength contributed by occasional cross walls. The planking was very soon removed, and York stone steps and proper underpinning substituted.

Although portions of the church walls, from the parapets down to the plates receiving the gallery floors were leaning outwards, it was found that all beneath was nearly upright ; of course this led to an examination of the ceiling, in which, at about the middle, a wide crack appeared running from the west towards the east end. On examining the roof, it appeared that the fissure, and the overhanging of the walls was caused by the pressure outward of the principal rafters, and chiefly on the south side of the church. This pressure outward had disjoined the tie beams, which had been scarfed in no very judicious manner in the middle, (the church being about 59 ft. wide) the scarfing was merely bound together by slight iron bands, and thin iron ties, depending on staples at their turned up ends and some spikes to restrain the lateral thrust; which force had almost wholly disengaged these contrivances, and amply accounted for the effects observed. The roof is of a mixed character uniting the king-post and queen-post arrangement. The queens were framed into the upper rafters, and those rafters, the tie beam and the king-post united and made a roof independent of the other timbers; the usual straining beam between the heads of the queen posts being omitted. The disarrangement of the timbers of the roof, by settlements common to them, and the displacement caused by the thrust, made it proper to prepare for the operation, of drawing the separated scarfed ends of the tie-beams something closer; it not being intended to give very much further effect to the power contemplated, because it might have produced injury to the entire roof, and to the upper part of the walls, the gutters and slating—at least it was considered injudicious to risk so much probable damage.

The object was only to prevent a greater separation of the tie beams at their scarfings, to stop any further thrust to the walls ; and it appeared that, by drawing the lower ends of the queen-posts nearer to each other, each having a tendency to urge back its moiety of the tie beam towards the centre, that much might be done, and at no great expense. It being found that the queen-post mortices in the tie-beam were far from being filled by the tenons of the queens, and that to draw them much out of the perpendicular, might produce a further and serious disarrangement of the timbers above. To keep the queens upright, and therefore nearly parallel to each other. the timbers were bolted together through the heads of the queens, through the struts, and through the middle of the king-post, and iron blockings, intended to oppose any movement more than desirable, were carefully fitted and bolted to the top of the tiebeam at the foot of each queen-post. The application of iron rods having powerfully threaded screws and ample washers and nuts, was of course a matter of easy accomplishment, and when put into operation, there would evidently have been no difficulty in bringing the ends of the timbers into close contact; but, as above stated, there was no wish to effect much more than full security ; and they were only drawn together enough to close in part, the fissure in the ceiling. As will be evident on reflection, this operation of drawing together the posts might, without due care, have left the tie beams without any check to their tendency to sag, and it was therefore found proper, at the time the iron blockings were fixed on to the top of the tie-beams, to saddle on them iron straps, bolted well through the tie-beams.

The authorities of Clapham church, not doubting the stability of the edifice, directed, in October last, the execution of two additional galleries for about 150 children, when the consequent scaffolding afforded the opportunity of a close examination, and it was very satisfactory to observe that the operation has been completely successful, and that no settlement, nor spreading of the roof, nor further overhanging of the walls, has taken place.

Feb. 20.—T. L. Donaldson, Esq., V. P., in the chair.

Mr. Godwin read a paper on *Church Building*, which is given in another part of the *Journal* for the present month.

C. W. Wooley read a paper on the *Walhalla*, which we propose to give next month, with engravings.

LICHFIELD SOCIETY FOR THE ENCOURAGEMENT OF ECCLESIASTICAL ARCHITECTURE.

The first annual meeting of the members of this society was held on the 5th of January, at the Diocesan School Room, at Lichfield, and, was numerously attended. The chair was taken by the Rev. Prebendary Gresley, upon the motion of the Hon. and Very Rev. the Dean of Lichfield. The report of the Proceedings of the committee for the past year was read by Richard Greene, Esq., F.S.A., Hon. Sec.; and we are glad to perceive thereby that, although in its infancy, and with but small present available funds, the society is stimulating the desirable object of church restoration upon correct principles, and is, in conjunction with sister societies, strenuously resisting the gradual destruction of our venerable churches by time, and that greater innovator, ignorance. We trust the day is arrived when the beautiful remains of those fabrics raised by the piety and skill of our forefathers, and venerated by us, will be rescued from the tender mercies of agrarian churchwardens, and own the fostering care of better guardians.

The report was followed by an address from the Chairman, in which he set forth, in his usual plain and felicitous style, the leading characteristics of Gothic architecture, from the earliest period to its abasement in the reign of Elizabeth, and offered some strictures upon the cheap church building of modern times.

Thomas Johnson, Esq., followed the chairman, with some most excellent practical remarks upon the care to be observed in effecting what are termed restorations. He admitted the great utility and advantage to be derived from the combined talent and enquiries of such societies ; but, as a practical architect, he held out a warning to their members to remember the ancient adage, "*Ne sutor ultra crepidam.*"

The proceedings were concluded by the honorary secretary, Richard Greene, Esq., who read a paper upon the sculptures of Norman architecture, in which he advanced the somewhat startling opinion that our earliest Christian church embellishments are essentially pagan, and of idolatrous origin. He supported the proposition with great ingenuity, and most interesting facts, elucidating the paper throughout with numerous drawings.

METROPOLITAN IMPROVEMENT SOCIETY.

On Wednesday evening, 22nd ult., a meeting of the Metropolitan Society was held. Mr. J. Ivatt Briscoe in the chair. The chairman congratulated the meeting on the attainment of one of the principal objects of the society —the appointment of a government commission to prepare a comprehensive plan of metropolitan improvement. From a letter in the hands of the secretary of Sir Robert Peel, it appeared that the new commission had commenced its labours by inquiring into the expediency of an ordnance survey and map of London upon the largest scale, and it was understood that the commission was now engaged in considering the various plans proposed for an embankment of the Thames. Mr. Martin, the painter, said, that for fourteen years he had been engaged in promoting the two-fold object of throwing open the banks of the Thames, and of converting the contents of the sewers, now flowing into the river, to agricultural uses.—Mr. W. E. Hickson observed, that some idea of the pecuniary value of the liquid manure, now permitted to be lost, might be formed from the fact, that in Paris a new contract had recently been signed, by which the contractor agreed to give the city 22,000*l.* for the contents of the cesspools of Paris. Mr. Fowler observed, that as numerous private interests would be affected by an embankment of the Thames, it was very important to watch any proceedings relating to this object, in order that the public interest should not be sacrificed. Mr. W. Lindley was anxious that the new commission in considering any plan for the embankment of the north side of the river, should inquire into the practicability of connecting it with the Essex road by means of a new and broad street running from Aldgate to the Thames, so as to form a practicable carriage thoroughfare from the west to the east of London, which now could scarcely be said to exist.

MODERN CHURCH ARCHITECTURE.

A very clever little periodical, *The Ecclesiologist*, published by the Cambridge Camden Society, has already done much good in counteracting the churchwarden barbarisms that have been too often committed in many of our churches; it is also creating a taste among the clergy for Gothic architecture, which will ultimately be of great service to the profession, and act as a counteraction to the selection of inferior designs by "Building Committees." The selection is frequently governed by favouritism, and much oftener by the want of true taste in those who are appointed to select the designs out of probably 50 or 60 that may be laid before them. We quite agree with the following hint on modern church architecture, and consider that too much attention and money is bestowed in highly finishing the stone work, carving, and other ornaments, when frequently rough scabbled stone work will produce a more pleasing effect than the highly wrought stone, and be done at one-half the expence, consequently it may be used less sparingly than it now

is; in fact, very frequently the whole church may be built or faced with such stonework as cheap as with brickwork.

"How often do we," says the *Ecclesiologist*, "see a simple village church, consisting, it may be, of low and rough stone walls, surmounted, and almost overwhelmed, by an immense roof, and pierced with some two or three plain windows between as many bold irregular buttresses on each side, or having a short massive tower placed at one corner, or in some seemingly accidental position, which nevertheless every one confesses to be as picturesque and beautiful and church-like an edifice as the most critical eye or the most refined taste could wish to behold. And just such another church could be built, perhaps, for seven or eight hundred pounds; while a modern early-English design, with all its wouldbe elegancies of trim regular built buttress, tripellancet, and curtailed chancel, would contain no more kneelings, cost more than twice the money, and look like a 'gothick factory' after all. And why is this? Because a lofty tower must be built instead of a simple unpretending chancel; or because one-half of the money is expended first in procuring, ond then in smoothing and squaring, great masses of stone, or in working some extravagant and incongruous ornament, so that cast-iron pillars must be placed in the interior instead of piers and arches; whereas the small and rude hammer-dressed Ashlar, or rubble work, of the ancient model, has a far better appearance, and allows a larger expenditure where it is most wanted, in procuring solid, handsome, and substantial arrangements for the interior."

EDGE'S IMPROVED GAS METER.

Fig. 1.

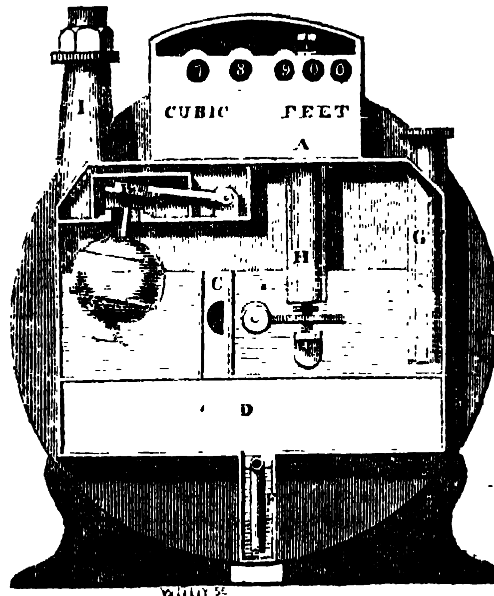
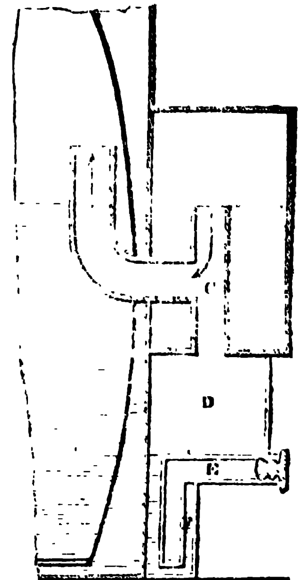


Fig. 2.



Considerable excitement has lately been raised respecting the gas meters, in consequence of Mr. Flower issuing a pamphlet accusing the gas companies of defrauding the consumer by the false registering of the meter, occasioned by filling the meter above the proper level with water; when that is the case, he contends that the meter is registering water instead of gas, whereby the consumer is suffering considerable loss. This did appear to us a very serious charge, and in this age of improvement we felt surprise that this "false registering" could not be avoided, and that there was no sc[illegible] me to adjust the water in the meter to the proper level, so that the meter should correctly register the exact quantity of gas consumed. Upon making some inquiry upon the subject, we very soon discovered that a meter, combining the requisites just alluded to had been invented and patented by Mr. Botten, and another by Mr. Edge, the well-known manufacturer of gas meters and fittings; but we consider the meter of the latter the best, as it combines other improvements. We have, therefore, much pleasure in presenting to our readers a description and engravings of Mr. Edge's meter, which appears to us to be as perfect as a wet meter can well be.

Fig. 1 is a front view of the meter, with the outer casing removed to show the interior, and Fig. 2 is a cross section of the front portion of the meter. A is the improved index. B, patent lever valve. C, syphon pipe. D, waste water cistern. E, F, hydraulic sealed outlet to allow the accumulation of water in the waste water cistern to be drawn off upon the removal of the plug at E. G, tube for filling the meter with water, which dips into the water, and consequently prevents the escape of gas. H, shaft and apparatus connected with index. I, inlet tube through which the gas passes into the meter through the valve B, thence down the pipe C, and again up into the interior or drum of the meter, as shown by the arrows in the section Fig. 2. Thence through spiral chambers within the wheel, as it revolves, to the outside of the wheel, and escapes into the surrounding chamber, and out at the outlet tube, on the top of the meter, at the back of the index box A. As the gas passes through the spiral chambers, the pressure of the gas causes the wheel to which they are attached to revolve, and with it its axis, which is prolonged and passes through to the front box, where, by means of an endless screw on the prolonged end of the axis working into a toothed wheel keyed on to the lower part of the shaft H, and a pinion on the upper part of the shaft, sets in motion the clock-work of the index, which shows the quantity of gas that passes through the meter.

There are several important improvements combined in Mr. Edge's meter, which we shall proceed to describe, the first and most important is an arrangement to prevent too much water being put into the meter. This is accomplished by the patent syphon C, and the waste water chamber D, the value of which cannot be over estimated; for, in the first place, it removes the only dangerous part of the meter, viz., the outlet from the syphon pipe, which is now sealed off; in the second place, it prevents the fraudulent abstraction of the water, to the serious injury of the company: and thirdly, it obviates the only tenable objection to the meter alluded to in Mr. Flower's pamphlet, that is, the accumulation of the water, by which the consumer is deprived of his full measure. The top of the syphon pipe C being placed on a line with the water level, every surplus drop must pass down it into the waste water box D, thence into the pipe F below, and when the plug is removed, it rises up the pipe F, and passes out at the orifice E; and as this pipe is bent downwards, it must always present an hydraulic joint to prevent the escape of any gas that might accumulate in the syphon C, and which, by the construction of the old meter, would escape when the plug was removed. Provided too much water be collected, it would prevent the influx of any gas, consequently it must be at once detected; the consumer would then have only to unscrew the plug E, and allow the water to run off, which may be done without the least danger. It will be observed that there is only one outlet screw, E, instead of two, as in the common meter.

The second improvement is the patent index A, which enables the consumer to ascertain the quantity of gas used with ease and certainty. The complexity of the old method, which consists of 3 dials with the movements of the hands or pointers, has been the occasion of very frequent mistakes and misunderstandings, even with the inspectors, and amongst the consumers has created a feeling of doubt and distrust injurious to the advancement of the meter. In the improved index, the figures are made to revolve instead of the hands; and as the only one figure required on each plate (to denote the number of cubic feet consumed) can be seen at a time, *no mistake can arise*, so that both parties will be satisfied. A reference to the engraving cannot fail to establish its great superiority, and show how the quantity may be read off as 78,900 without the chance of error.

The third improvement is the patent lever valve, B, the object of which is to prevent the numerous complaints of the consumers, and the very heavy losses to the companies, by the lodgment of the old valve, consequent on the corrosion of the guide wires; this lodgment can rarely, if ever, be proved by ocular demonstration, as the slightest movement will cause the valve to fall into its seat, but still it is proved daily, *and beyond all question*, by a diminished registration; and it is not the less objectionable, as an evil, for being a secret and invisible one. The lever valve completely and effectually remedies this; it also indicates a deficiency of water much earlier than the old valve, and the shield protects it at once from any sudden rush of pressure; it may, in fact, be considered perfect in its action, and unassailable on every point.

DRAWING SCALES.

Mr. Drake, of Elm-tree-road, St. John's Wood, land-surveyor, has obtained a patent for making scales for laying down plans, of the same paper as that on which the plan or drawing is laid down. The scales are intended to accompany the plans to which they belong, and being of the same material, they consequently expand or contract, by changes of temperature, in exactly the same proportion as the plan. The paper to be drawn upon is mounted on linen or cotton, by means of India-rubber cement, and, on a strip of it the scale is made. The under surface of the straight edge or holder, by which the scale is held, whilst being used, is rabbetted, and covered with a piece of paper or linen, so as to form a space for the reception of the scale; and the off-set scale, used with it, has a small metal frame at one end, which works against the edge of the holder.

GALVANIZED IRON.

About five years since a patent was taken out in this country, by M. Sorel, for the purpose of galvanizing iron, by a process of coating it with zinc, in a similar manner to tinning, but for some cause, we believe a dispute among certain capitalists, this patent has been allowed to remain in abeyance, during which period, it has been in considerable use in France, and is, at the present time, we understand, extensively employed by the French government. It is now taken up in this country by some spirited individuals, who have established large works in London for zincing iron to any extent. The process may be applied to both cast and wrought iron in any form.

"The effect of zinc in protecting iron from oxidation," says Professor Graham, "has been known to chemists for some time. When these two metals are in contact, an electrical or galvanic relation is established between them, by which the iron ceases to be susceptible of corrosion by dilute acids, saline solution, or atmospheric humidity. It was found in experiments lately conducted at Dublin and Liverpool, that small pieces of zinc attached to each link of a chain-cable were adequate to defend it from corrosion in sea water. The protection was observed to be complete even in the upper portion of the iron chains by which buoys are moored (and which, from being alternately exposed to sea water and air, is particularly liable to oxidation.) so long as the zinc remained in contact with the iron links. The protecting influence of the zinc could not be more certainly secured than in the articles prepared by the patent process, the iron surface being uniformly coated over by that metal. In trials to which I have had an opportunity of subjecting them, the iron escaped untouched in acid liquids, so long as a particle of the zinc covering remained undissolved. The same protection is afforded to iron in the open atmosphere by zinc, with a loss of its own substance, which is inappreciably minute. The zinc covering has the advantage over tinning, that, although it may be worn off, and the iron below it partially exposed, the iron is still secured from oxidation by the galvanic action, while the smallest quantity of zinc remains upon it; whereas tin, in common tin plate, affords no protection of this kind, and not being absolutely impermeable to air and moisture, the iron under it soon begins to rust in a damp atmosphere. The simplicity and perfect efficacy of the means employed to defend iron from the wasting influence of air and humidity in this process of *zinc tinning*, certainly entitle it to be ranked as one of the most valuable economical discoveries of the present age."

DR PAYERNE'S PATENT FOR PURIFYING AIR.

An abstract of this patent appears in the *Mechanics' Magazine*; it is granted to W. R. Vigers, Esq. of Russell-square, on behalf of Dr. Payerne, "for a mode of keeping the air in confined places in a pure or respirable state, to enable persons to remain or work under water and other places, without a constant supply of fresh atmospheric air."

The first thing claimed and specified is the depriving the atmosphere in confined places of the carbonic acid gas which it contains, produced from respiration or combustion, by means of quick lime and caustic alkali, or of the lime alone, which is to be dissolved in eight times its weight of water. The air in the apartment is to be passed through this caustic solution by a pair of bellows, the nozzle of which reaches nearly to the bottom of the vessel containing the lime and water. The vitiated air thus coming in contact with the lime, the carbonic acid gas is absorbed. It is calculated that one cubic foot of atmospheric air must be purified for each person per minute.

2. The patentee claims the restoring the requisite quantity of oxygen, to supply the place of that consumed; which oxygen is to be procured from the chloride of potash, or driven off from the peroxide of manganese by means of heat, into the apartment or allowed to escape from vessels into which it may have been previously compressed.

3. The patentee claims further, the purification of the air contained in the diving bell, by the process described in claim 1, and the restoring the requisite proportion of oxygen from a vessel attached to the diving-bell, into which the oxygen had been previously compressed; also the allowing the escape of atmospheric air, which had previously been compressed several atmospheres, into two compartments, one of which is situated at each end of a diving bell, somewhat resembling a boat inverted, the centre one being occupied by the diver or workmen, who may, by means of stop-cocks, regulate the supply according to their wants.

The specification is of extraordinary length, filling no less than ten skins of parchment, but the above extract contains all that is material in it.

BITUMINOUS STREET PAVING.

Notwithstanding several unsuccessful trials of bitumen in the paving of carriage-ways, as in the Vauxhall Road some years ago, and more recently in Oxford Street, the Parisian Bitumen Company is at this time engaged in paving the square space opening into Hungerford Market, at the bottom of Hungerford Street, Strand. As this place is not subject to the same kind of wear and tear as a street through which a rapid traffic is constantly passing, it is possible that the bitumen may here answer better than in former trials, and in any case it may interest our readers to know the method pursued by the Company in their present operations.

The bituminous pavement consists of blocks a foot square and 6 inches in depth. These block are composed of an artificial bitumen and angular broken stones, forming a concrete of considerable tenacity. When the granite stones of the old pavement had been taken up and removed, a surface with a considerable convexity in a transverse direction was prepared to receive the bituminous blocks. These are then laid down in straight lines longitudinally, and breaking joint transversely. The blocks are not placed close together, but with a space betwen them of about one inch all round each block. This space is left for the purpose of being filled with melted pitch in order to fix the blocks in their places. These spaces or joints between the blocks are filled in with pitch at several different times; but when the pitch joint is only 2 or 3 in. in depth, the blocks are quite immoveable. When the first thickness of pitch has become quite solid, the joints are filled with the same substance up to the top, and before the top surface of the joint has time to set, a workman sprinkles it over with a sharp, yellow, large grained sea sand, which sets firmly in the pitch. The pavement, when finished, presents the appearance of an ordinary stone pavement, except that the blocks, instead of ranging in straight lines transversely across the road, are placed in straight lines in a longitudinal direction. We can see no good reason for this deviation from the old practice, while on the other hand it has obviously one great defect, namely, that the water falling on the surface is checked in its escape to the sides at every course of stones, and thus the surface of the roadway must be kept constantly wet. The unbroken transverse lines of joints in an ordinary pavement, answer the useful purpose of minute channels to convey the water off to the sides. It may be said that the bituminous surface will prevent the penetration of water, and that the water lodging on the surface is of no consequence. We cannot agree in this, but consider on the other hand that for this very reason bituminous pavement should always be laid with a slope in some direction, so that the water, which can only otherwise escape by evaporating, may drain off it as fast as it falls.

MISCELLANEA.

Stockton.—The bridge to substitute the Stockton Suspension Bridge is now in progress; two of the piers are completed—one on each side of the stream; and the gangways and travelling cranes are erected. Mr. Grahamsley of Newcastle is the contractor for the masonry, and Mr. Kitchen of Darlington, the contractor for the iron work. The foundation requires piles 50 feet long, and a 10-horse engine with a ram of 18 cwt., and three men to drive them. The stone piers are dressed in rockwork, six feet broad at top; the span is 83 feet 6 inches between the piers; the roadway is to be carried by cast iron bearers about 3½ feet deep. The site is about 100 feet above the suspension bridge, up the stream or to the west of it. It is not certain whether the suspension bridge will be taken down, or used as a turn-out for empty wagons.

Middlesborough Dock.—This dock was completed in the early part of 1842, and ships were admitted on the 12th of May in that year, and the shipment of coals has been carried on regularly in the dock since that time. It has an area of nine acres of water surface, and is entered by a commodious channel rather more than a quarter of a mile in length, leading from mid-channel of the river Tees. The entrance lock is 132 feet long, and 30 feet wide; the depth on the sill averages about 18 feet at spring tides, and 15 feet at neap tides; and the coping is 21 feet above the sill. The bottom of the dock is three feet under the level of the sills; the sides of the dock are sloped and paved with stones at the water's edge. For the shipment of coal there are 10 staiths or "drops," at each of which coals may be loaded at the rate of 5 keels, or 105 tons per hour. Ballast is taken out at a very low rate, by means of cranes situated at different places on the river banks. The branch railway leading from the Stockton and Darlington line, which communicates with the dock, is situated on the south side of the town of Middlesborough; it terminates in 10 lines of double railway leading to the 10 drops. The raised platform is covered by three diverging lines of railway, it comprises an area of 15 acres, and affords standage room for 1,200 loaded wagons, or more than 3000 tons of coal, besides ready means of egress for locomotives with their trains of empty wagons. Unfortunately the lock entrance has been constructed too narrow for steam tugs to enter, of which there are about 20 from 25 to 50 horse power. The channel from Middle Tees is very much liable to silt up, and requires constant dredging. Mr. Cubitt was the engineer, and Mr. Turnbull the resident engineer, and Mr. Briggs the contractor.

Lower Shannon Improvements, Ireland.—The works at Banagher are contracted for by Mr. William M'Kenzie, and consist of deepening all the fords in the river from Killalo to Athlone, either by dams and excavating, or by dredging. Two 12 horse dredgers are employed, and two weirs are to be constructed, 1100 feet long each, across the Shannon; also a lock 170 feet by 40 feet, and 8 feet rise to pass an 80-horse steamer; likewise a stone bridge at Banagher of 6 arches 60 feet span, and a 40 feet swivel bridge on one side to pass the steamer through. The works are under government, and are expected to be completed in the ensuing summer.

The Duke.—A new steam vessel, of 765 tons burthen, was launched at Liverpool on the 25th of January, having been built by Mr. Thomas Royden for the East India and China trade.

Alexandria.—We have already informed our readers, says the "*Ecclesiologist*," of our (the Cambridge Camden Society) engagement to supply designs and working drawings of a new church to be erected at Alexandria. These have now been completed by the architect, Mr. Salvin, and will be dispatched by the earliest post to their destination. As it may be interesting to many, and especially to the absent members of the Camden Society, to have some account of the form and plan of this church, we shall here subjoin a brief description of it for their information. The entire length of the church externally is 128 feet by 50 feet in breadth (exclusive of a north and south porch). The plan comprises a full and spacious chancel, 40 feet by 18 feet internally, and a nave and aisles, 78 feet by 40 feet; and a tower with a lofty spire is to be added, if funds can be procured, in the place of the south porch. The chancel is raised by three steps, and is furnished with all the proper appurtenances of stalls, priest's door, credence, sedilia, and piscina. The seats in the nave are ranged in four parallel rows facing the east, there being a passage of 5 ft. 9 in. in the centre, and one of 2 ft. 6 in. in each aisle next to the piers. The seats are, of course, all open. The west front, adapted from that of Llanercost Abbey, exhibits a beautiful façade made by the nave, which is terminated by a high-pitched roof with a gable cross between two large pinnacle turrets, and has below a lofty arcade pierced with two lights, and the two aisles, each of which carries a separate gable with a cross, and a single lancet light. To this front the north porch and southern tower will add great breadth and diversity of effect. The chancel, nave, and aisles will be vaulted; and the clerestory lighted by a circular window in each groined compartment. The aisles are lighted by single lancets between buttresses with pedimented heads and set-offs. The east end will have a peculiarly beautiful effect, from a richly arcaded triplet with a wheel window above, and from the lofty gables of the chancel, nave, and aisles, all of which will be surmounted with crosses, and are similar in design to the west end. The sides of the chancel contain three bays, each of which is arcaded of three, with the central arch pierced for a lancet light. Every portion of this church has been designed in strict conformity with ancient models.

Lancashire.—We have been permitted by the architect, Mr. Sharpe, of Lancaster, a member of our Society, to inspect the plans and working-drawings of a new church which he is now erecting at Knowsley, in Lancashire. There are many points in this design which deserve great commendation, and as a whole, it may safely be pronounced a most successful example of modern church building, although some of the arrangements appear to us liable to serious objection. The church is of the early-English style, and consists of a good chancel, nave with aisles, and tower with broach spire at the west end. There will be no galleries, and the ground-floor alone will accommodate 100 worshippers. There is a well-defined clerestory, supported by beautiful clustered piers and arches, and surmounted by a very fine high-pitched roof, the trusses of which spring from triple-shafted corbels, with floriated capitals. The walls of this church are somewhat too thin to allow of the proper internal splay of the lancets, and appear to us to be too much and too *regularly* pierced. Thus each side of the aisles and clerestory exhibits an equal number of lancets, placed exactly opposite to each other. We should have preferred single lights in both positions, for a church *should be dimly lighted*; or the clerestory might have had foliated circles (a beautiful early-English feature, which we wonder is not more frequently introduced), and the aisles plain two-light windows with circles in the heads. There is too much sameness in so great a number of lancet windows. The nave roof might have been carried up to the belfry windows with better effect. The tower is very good, and has nothing to which we can object, excepting a number of small trefoil apertures which are intended to light the staircase, but which should rather have been plain oblong slits in the wall. There is, we suspect, but scanty ancient authority for such ornaments, unless in very magnificent towers, and they appear singularly inappropriate when placed just below the point where the broach meets the top of the tower, since this part ought especially to convey the idea of strength and solidity. Small apertures, however, of this description occur in St. Mary's tower, Stamford. The northern porch (we should have much preferred a southern one, or at least a southern door should have been added, as at Woodton, Norfolk; Irnham, Lincolnshire; and of later date, Grantchester and Chesterton churches, near Cambridge,) has too large a doorway, and its roof does not meet that of the aisle in a pleasing manner. The west door would be very good if the mouldings were less meagre and ornamental. A tower doorway of this style should be very deeply recessed, and have a great display of arch moulding. The details in general are very good, and have the rare merit of being at once extremely correct and varied in form. We have several grave objections to make against the internal arrangements. There is no central passage to the altar; but the space which ought to have been left for this purpose is occupied by seats for children. The tables of commandments, creed, &c. are placed in an arcade above the chancel arch—a modernism which we consider altogether inadmissible, to say nothing of its bad effect. We should be inclined to carry the chancel arch considerably higher. The organ is at the east end of the north aisle; it should rather have been at the west, and a window at the east end. The font is too nearly the centre of the nave; its correct position is by the west pier nearest to the porch. Upon the whole, however, great praise is due to this design; but we deeply regret to observe that some of the internal details are to be executed in *plaster*. We had much rather that they had not been attempted at all. Under the chancel is a vaulted crypt, and above it we observe with no great satisfaction a contrivance for warming the church with hot air.—*Ecclesiologist.*

New Military Church at Windsor.—The last stone of the spire of the new military church was laid on Friday morning, Dec 30. The first stone of this building was laid on the 4th of April last. The church is built of white brick and Bath stone, and its architecture is pure Gothic: it is in the form of a crucifix, having two large transepts for the accommodation of the military and the one at the west end for the children. These galleries are calculated to contain between 400 and 500 persons. A certain portion of the church will be set apart for the accommodation of the soldiers' wives. The body of the church will be fitted up with beautifully carved oaken benches, by which, whilst this arrangement will afford a great number of sittings, will present a light and elegant appearance at a much less cost than the erecting of pews. In addition to the accommodation afforded to the military, there will be about 1,000 sittings for the inhabitants of Windsor and Clewer. The principal feature of this church is the beautiful tower and spire, the tower being nearly 100 feet high, and the spire, of Bath stone, rising 48 feet, surmounted by a vane. The cost of this edifice will be about £10,000, nearly one-half of which is already subscribed, Her Majesty and Prince Albert being large contributors. The building is designed by Mr. E. Blore, and when complete will form a magnificent object from the Castle and surrounding neighbourhood, being one of the most beautiful designs on this side of the metropolis. The whole of the plans have been carried out with great accuracy by Mr. J. B. Heard.

The Prince Albert.—A new iron built steamer of the above name, has been making several trips up and down the river Thames, trying her speed, which proves to be very superior, and equal to our fastest steamers; at present she has exceeded the speed of all that she has been able to compete with, even the far famed "Railway." She is an iron built vessel, the deck beams are also of deep angle iron, to which the deck planks are bolted down; her length is 155 ft. between perpendiculars; extreme breadth 19 ft. 6 in.; draught of water when loaded, 4 ft. 6 in; length of saloon, 36 ft.; fore cabin, 30 ft.; engine room, 26 ft. The engines are of the direct action principle, constructed by Messrs Braithwaite, Milner, and Co., and are a beautiful specimen of workmanship, and occupy an extremely small space. The diameter of steam cylinders, 40 in; length of stroke, 40 in.; nominal h. p. of the two engines, [illegible] horses, with 32 revolutions [illegible] minute [illegible] diameter of paddle-wheels, 17 ft. 6 in.; breadth, 9 ft.; space occupied [illegible] 10 ft. 8 in. in the breadth, and 6 ft. 6 in. in the length of vessel. The engines are constructed with two piston rods to allow the piston in the centre to be hollowed out, that the cover may be dished in a similar manner, to allow the connecting rod and cross-head to descend partially into the cylinder, that the length of connecting rod may be as long as possible, which is equal to three times the radius of crank, or five feet: the air-pump and feed-pump are worked from either end of the cross-head, the boilers are tubular, on *Spiller's* construction. The time occupied in the passage from Blackwall to Gravesend, the day we were on board, was 1 hour 13 minutes, with a slack tide, but against the wind, and 1 hour 5 minutes returning.

Imperador.—This steam vessel is the first of a pair built for the Post-office service in the Brazils which business is performed by a private company. She was built by Messrs Fletcher, Son, and Fearnall, from the designs of Messrs. Ritturden and Carr. (Mr. Ritturden is the surveyor of shipping to the honourable the East India Company.) She is a very superior [illegible] of Thames building, and her arrangements and cabin fittings are in a style [illegible] extreme neatness [illegible] comfort. The length between perpendiculars, 151 ft. [illegible] over all 169 ft. 6 in.; breadth, extreme to a 3 in. plank, 24 ft.; depth in hold 14 ft.; burthen, old measurement, 118 tons; her draught of water, loaded, is 9 ft. 3 in. forward, and 10 ft. 2 in. aft. She has two engines, of the collective power of 140 horses, constructed by Messrs. Miller, Ravenhill, and Co. They are finished in a superior manner, and work most satisfactorily, the speed of the vessel in the river, with every thing on board, and the coal boxes full, was 10½ statute miles per hour. The vessel left London on the 5th ultimo for South America, and performed the distance from Blackwall to Falmouth Harbour in 42 hours, consuming from 9 to 9½ cwt. of coal per hour, with the steam up to 5½ inches, and the barometer standing at 27½ inches; the engineer reports that he had plenty of steam, and the firing very easy.

The Bentinck.—This fine steam vessel, which has been for some time building as a companion to the *Hindostan*, was launched on the 25th of January, from the yard of Mr. Wilson, at Liverpool; she is proposed to be nearly a fac-simile of the *Hindostan*, and was moored in the Trafalgar Dock, to be completed, and to receive her engines, which are being constructed by Fawcett and Co.

The Royal Mail Steam Ship "Hibernia."—Another superb ship has been added to the fine fleet of steamers belonging to Cunard's line, running between Liverpool and Halifax. She was built at Greenock, by Messrs Steele and Co.; burthen 1350 tons, length between perpendiculars 218 feet, and depth of hold 24 feet. Her engines were constructed by Mr. Robert Napier of Glasgow, and are of the nominal power, the piston travelling 220 feet per minute, of 550 horses collectively, the diameter of cylinders is 77½ inches, and length of stroke 7 feet 6 inches, the paddle wheels 30 feet 4 inches diameter.

Electric Telegraph.—Mr. Cook, the joint patentee with Professor Wheatstone, of the voltaic telegraph, has been commissioned to lay down a line from the Paddington station of the Great Western Railway to Windsor Castle, and carry it thence to the Parliament houses and Buckingham Palace. The effect of this will be, that on important occasions, when the sovereign may be at Windsor, any intelligence of extraordinary interest can be transmitted to her Majesty in a second—nay, in less time. The voltaic electricity which governs the motion of the telegraph, travels at the rate of two hundred and eighty-eight thousand miles a second. This has been proved by the delicate instrument invented by Professor Wheatstone. The new and most singular arrangement will be of great value in connection with the public service. When cabinet councils sit on momentous questions, her Majesty can be acquainted with the result of their deliberations as instantaneously as if she

were present. When the Queen presides over the meetings of her ministers in person at Windsor, it not unfrequently happens that information on a particular subject may be required from the departments in London; and hitherto, when this has been the case, it of course became necessary to send an express to town to obtain what was called for, before the business could satisfactorily proceed. Now it, in most cases, will be procured while the council is sitting, and, indeed, in the course of four or five minutes, which before would have caused a delay of as many hours. This will not only be of use on great occasions, but in a common way its every-day value will be considerable. During the session of parliament, for instance, on every question of interest her Majesty can learn the division, or the progress made in a debate, one moment after the house has divided, or any particular orator has risen to speak or resumed his seat. Thus, a more rapid communication between the sovereign and her ministers for the time being will be established than has ever been known or thought of before.—*Mirror.*

The Birmingham Town Hall Organ has undergone great alterations. These consist of certain new arrangements and adaptations, founded on an extensive survey of the great organs both in Germany and Holland, and will have the effect of greatly increasing the powerfulness, and variety of this splendid instrument, the recent improvements having caused an addition of about 1200 pipes. The height of the case is 54 feet, and 40 feet wide, and, contains about 4000 pipes. The circumference of the CCC metal pipe is 5 feet 5 inches, the largest wood pipe (the CCCC) is 12 feet in circumference, and its interior measurement is 224 cubic feet. The organ contains 63 real stops, six copulas, and has four sets of keys; the fourth is the combination or solo organ, upon which (by an ingenious contrivance) can be played any stop or steps out of the swell or choir, without interfering with their previous arrangement. There are several stops peculiar to this organ, and which are not to be found in any other; amongst them is the grand ophicleide, invented by Mr. Hill, which is distinguished by its immense power and richness of tone. The posaune is built on a large scale, and is by far the most powerful ever made. By coupling the pedals with the keys, 87 pipes are made to speak with each pedal. The bellows contain 300 square feet of surface, and upwards of 3 tons weight upon them is required to give the necessary pressure. The machinery of the organ is so very extensive, that the trackers, if placed in one line, would measure more than 5 miles.

Nankin and its Porcelain Works. Numerous, as you may conceive, have been the pilgrimages made to the far-famed "Porcelain Tower," for the first time in inspecting any of the monuments *renommés* of this country, no disappointment has been experienced, while comparing what actually is, with what the legends of the book-makers in China describe to be. It is, indeed, a most elegant and singular structure, as remarkable for its correct proportions as for the rare material of which it is partially composed. I say partially, because the mass of building is not of porcelain, but is composed of common brick, with a facing and lining of beautiful white glazed porcelain bricks or slabs, fixed into the masonry by means of deep keys or shoulders, cast like a half T. on the brick. Its form is octagonal, and running up each of the angles is a moulding of large tiles of very fine clay, glazed and coloured red and green alternately, round each story runs a high balustrade formed of green porcelain, upon which four arched doorways open, set to the four cardinal points, the arches being elegantly turned with large glazed tiles, cast in all imaginable fancies of design and variegation of colour representing wild beasts, demons, deities, monsters &c. It appears to be a "sight" amongst the Chinese themselves, for there are priests or bonzes attached to the building to keep it in order, who earn their consideration by distributing to the visitors lithographed elevations of the tower, with descriptions attached, and who seem to have the duty entrusted to them of illuminating it on gala occasions. This is effected by means of lanterns made of thin oyster shells, used in lieu of window glass by the Chinese, which are placed at each of the eight angles on every story, and the effect of whose subdued light on the highly reflective surface of the tower must be most striking and beautiful.—*Bombay Spectator.*

Florence.—*The Duomo.*—The grand Duke has given orders that the "Gran Duomo" of Florence shall be completed under the direction of the Imperial Academy. The dome was begun to be built in 1296, by Arnolfo di Lapo. In the works now to be commenced, the materials to be employed are marbles from the quarries of the two mountains Seravezza and Altissimo, in some respects more beautiful than those of Carrara, and they are those which Michael Angelo made use of.

THE VARIATION OF THE COMPASS.

Observations made at the Royal Observatory, Greenwich,

G. B. Airy, Astronomer Royal.

Mean Magnetic		Declination.	Dip at 9 A.M.	Dip at 3 P.M.
		° ′ ″	° ′	° ′
1842	October ..	23 18 4		
	November ..	23 17 22	68 56½	69 0¼
	December ..	23 17 22	68 56	68 59¼

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM JANUARY 31, TO FEBRUARY 25, 1843.

Six Months allowed for Enrolment, unless otherwise expressed.

George Benjamin Thorneycroft, of Wolverhampton, ironmaster, for "*improvements in furnaces used for the manufacture of iron, and also in the mode of manufacturing iron.*"—Sealed Jan. 31.

William Maugham, of Newport-street, Lambeth, chemist, for "*an improvement in preparing aerated water.*"—Jan. 31.

William Barnard Boddy, of Saint Mary, Newington, surgeon, for "*improvements in apparatus and means for opening, shutting, and fastening every description of sliding and lifting window sashes, windows, and window shutters.*"—Jan. 31.

William Robinson Shaw, of Leeds, engineer, for "*improvements in feeding or supplying steam boilers with water.*"—Jan. 31.

Samuel Kirk, of Staly-bridge, Lancaster, cotton spinner, for "*improvements in machinery or apparatus for preparing cotton and other fibrous substances for spinning.*"—Jan. 31.

Charles Hancock, of Grosvenor-place, artist, for "*an improved means of dyeing or staining cotton, woollen, silk, and other fabrics, and rendering them repellent of waters and moisture.*"—Jan. 31.

Charles Clark, of Great Winchester-street, London, merchant, for an "*improved pyro-hydro pneumatic apparatus, or means of generating, purifying, and condensing steam and other vapours, and of extracting from vegetable substances the soluble portions thereof, as also the application of parts of the said apparatus to other heating, evaporating and distilling purposes.*"—Jan. 31.

James Clark, of Glasgow, power-loom cloth manufacturer, for "*an improved mode of manufacturing certain descriptions of cloths.*"—Feb. 1.

John Hill, of Manchester, machine-maker, for "*improvements in or applicable to looms for weaving carpets and various other fabrics in which raised loops or a raised pile constitute the face or the figure of the fabric.*"—Feb. 11.

Robert Hicks, of Old Burlington-street, surgeon, for "*improvements in apparatus for impregnating liquids with gases.*"—Feb. 11.

Joseph Morgan, of Manchester, manufacturer of patent candle-making machines, for "*improvements in the manufacture of candles.*"—Feb. 11.

Jonathan Badger, of Sheffield, carpenter and builder, for "*improvements in the construction of bedsteads for invalids.*"—Feb. 11.

Christopher Nickels, of York-road, Lambeth, gentleman, for "*improvements in the manufacture of fabrics made by lace machinery.*"—Feb. 11.

Thomas Ensor, of Milborne Port, glove manufacturer, for "*improvements in the manufacture of leather gloves.*"—Feb. 11.

Henry Du Bochet, of South Mall, Ireland, piano-forte tuner, for "*a new method of making pianofortes.*"—Feb. 11.

Thomas Wolverstan, of Salisbury, iron founder, for "*improvements in axletrees and axletree boxes.*"—Feb. 11.

Alfred Brewer, of Surrey-place, Old Kent-road, wire-weaver and felt manufacturer, for "*improvements in machinery for manufacturing paper.*" (A communication.)—Feb. 11.

George Ebenezer Doudney and Edward Phillips Doudney, of Mile-end, Portsea, candle manufacturers, for "*improvements in the manufacture of dip and mould candles.*"—Feb. 17.

James Boydell, jun., of Oak Farm Iron Works, near Dudley, ironmaster, for "*improvements in apparatus for retaining the wheels of carriages in the event of an axis breaking, or otherwise.*"—Feb. 17.

Henry Ross, of Leicester, worsted manufacturer, for "*improvements in combing and drawing wool, and other fibrous substances.*"—Feb. 17.

Charles Brook, of Meltham Mills, York, cotton spinner, for "*improvements in the apparatus used for purifying gas.*"—Feb. 17.

William Newton, of Chancery-lane, civil engineer, for "*an improved system of working coal mines and quarries of stone, marble, and slate, which may also be applied to the making of tunnel borings, or to other purposes of the like kind.*" (A communication.)—Feb. 20.

John Kymer, of Pontardalaw, South Wales, coal proprietor, and Thomas Hodgson Leighton, of Llanelly, Carmarthen, chemist, for "*improvements applicable to the burning anthracite or stone coal, and other fuel, for the purpose of obtaining heat.*"—Feb. 21.

Joseph Crannis and Robert Kemp, both of Southwark, furriers, for "*improvements in wood paving.*"—Feb. 21.

Benjamin Brunton Blackwell, of Newcastle-upon-Tyne, gentleman, and William Norris, of the city of Exeter, civil engineer, for "*an improvement in coating iron nails, screws, nuts, bolts, and other articles made of iron with certain other metals.*"—Feb. 21.

Lawrence Holker Potts, of Greenwich, doctor of medicine, for "*new or improved methods of conveying goods, passengers, or intelligence.*"—Feb. 21.

Henry Clarke, of Drogheda, linen merchant, for "*improvements in machinery for lapping and folding all descriptions of woven textures and surface fabrics.*"—Feb. 23.

Francis Roubiliac Conder, of Highgate, Middlesex, engineer, for "*improvements in the cutting and shaping of wood, and in the machinery for that purpose.*" (A communication.)—Feb. 23.

John Haggerston Leathes, of Norwich, gentleman, and William Kirrage, of the same place, asphalte manufacturer, for "*improvements in coffins.*"—Feb. 25.

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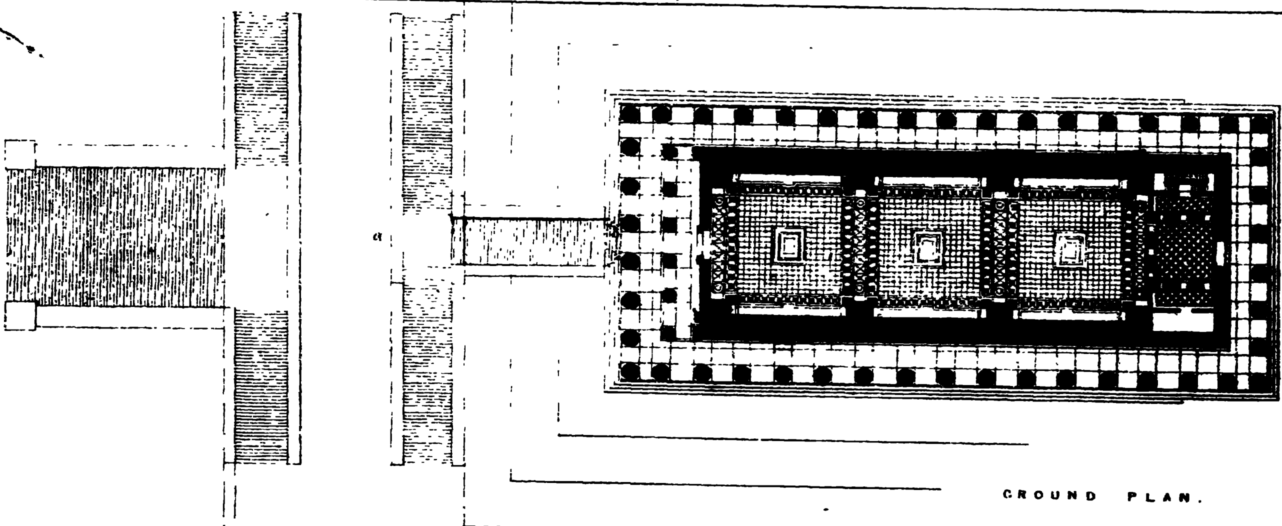
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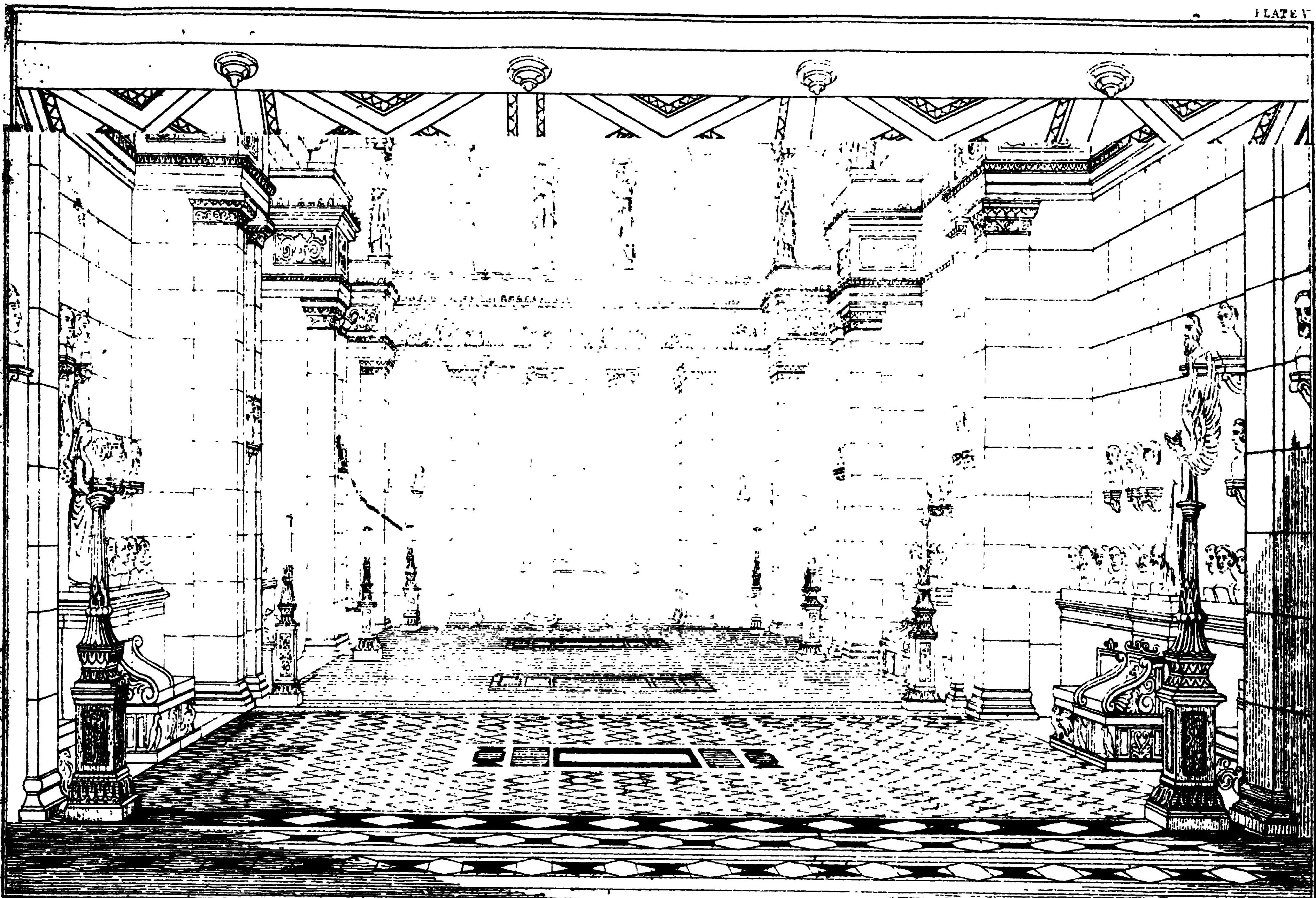
The WALHALLA.





J. R. Jobbins, 3, Warwick Ct.

PLATE V



J R Jobbins litho Warwick C.

INTERIOR of the WALHALLA,

THE WALHALLA.

Description of the Walhalla, read at the Institute of British Architects,
BY JOHN WOOLLEY, FELLOW.
(With two Engravings, Plates IV and V. [1] *)*

THE idea of raising a monument to the great men of Germany originated with the present king of Bavaria. While he was Crown Prince, and only 20 years of age, he conceived the plan of raising a vast edifice for the reception of busts of illustrious men of every state in Germany, whether Bavarian, Prussian, or Austrian, without distinction, beginning from the earliest records of German history, and including princes, philosophers, warriors, poets, artists, and learned men,—all who might have distinguished themselves by their virtues or their genius. It was in 1804, according to the inscription upon the pavement of the temple, that this noble project was first contemplated by the prince; and though delayed and interrupted at that period, and for some years subsequently, by the disturbed state of his country, his design was never abandoned; but, conceived as it was in youthful ardour, it has been prosecuted with manly energy and constancy, and at length, in the summer of last year, received completion in the magnificent edifice, the Walhalla, which now adorns the banks of the Danube at Ratisbon.

The character given to the building by its mythological appellation, is carried out by the sculpture which adorns the interior, and Klenze has made this "voice of architecture," as Mr. Cockerell terms it, an organ to awaken among artists an interest in a mythology which has been most undeservedly neglected. The adaptation of the national fables of the early Germans to a building so entirely national in its conception as the Walhalla, is most appropriate, and certainly the most original feature of the design. Except merely to state that the name received the consideration of many learned men, the architect has offered no remark upon this employment of the Gothic mythology: probably because the subject is much more familiar to Germans than to Englishmen. For this reason I shall offer no apology for prefacing the description of the Walhalla by a brief account of its mythological prototype, and by a few words upon the northern mythology.

The study of mythology has always held a foremost place in modern education, because the knowledge of the religion professed by the early inhabitants of a country is so essential to the understanding the works of ancient authors, and in order to aid the investigations of the customs and monuments of antiquity. But why the Paganism—called, by way of excellence, classic—should have engrossed so much attention, to the exclusion of a mythology which has so much more claim upon our national sympathy, has been frequently asked, but remains still to be answered. As long ago as the year 1800, the University of Copenhagen considered the matter of sufficient importance to give, as the subject of a prize essay, the question, "Whether the Northern mythology is worthy of equal rank with the Grecian." The question was decided in the affirmative by all the candidates, and Muller, Ohlenschlager, Dalins, and others in their subsequent illustrations of the subject, have fully justified their decision. Without discussing the degree of merit to which each is entitled, it will be readily granted that the Scandinavian mythology, independent of any intrinsic beauty it may possess, has this one great claim upon our attention over the Paganism of Greece and Rome: namely, that we, as well as the other countries of Northern Europe, may esteem these magnificent superstitions as having been the religion of our forefathers; for while the worship prescribed by the Greeks extended itself in Europe no farther than Greece and Italy, the major part of Gaul, Scandinavia, Germany, and Britain, cultivated a mythology and literature peculiarly their own,—a mythology which gives a striking picture of our northern ancestors, and to which our customs, antiquities, and language make perpetual reference.

Upon the conquest of England by the Saxons, the ancient Britons were driven to seek refuge, the principal part of them in that part of France then called Armorica, to which they gave the name of Brittany, and the few that remained in this country in the remote corners of Wales and Cornwall. With their language and their customs the victorious Saxons introduced their fables and their sagas, and the worship of Odin was established throughout the heptarchy.

Hume speaks of the religion of the Saxons as "consisting of superstitions of the grossest and most barbarous kind, as one of which little is known, and which, compared with the systematic and politic institutions of the Druids, made little impression upon its votaries, and which accordingly gave place to the new doctrine" (of Christianity). This is not true; the worship of Odin was one of all others calculated to dazzle and captivate the imagination of a warlike race like the Northmen; and that the laws of that great conqueror took deep root wherever they were propagated,—that is to say, throughout the north,—is beyond all question. Christianity eventually triumphed, not easily, or because it met with no opposition, as Hume supposes; but because truth must prevail over superstition and error. But even Christianity and the lapse of more than eleven centuries have failed to eradicate altogether the traces of this worship: of which fact the names of the days of the week in almost all the languages of Northern Europe is the most familiar instance. The rites of the Druids were the most terrible ever known: their barbarous wicker idol immolations were unknown among the Gothic nations. And another principal feature of their institutions was the profound ignorance which it was the policy of their priests to maintain; for they most carefully concealed their doctrines from the vulgar, forbidding that they should ever be committed to writing: and on this account they had not so much as even an alphabet of their own. The institutions of Odin were entirely the reverse of this. No barbarous people were ever so addicted to writing, as appears from the innumerable quantity of Runic inscriptions scattered all over the north, not excepting England and Scotland. The invention of letters was considered the offspring of Divine intellect, and ascribed to their chief deity; and the characters themselves were supposed to be possessed of magic virtues. The Edda, the Voluspa, and the sagas of this heathen period are still preserved, and are written in a language which is the parent of all the Gothic dialects. The Havamaal, or sublime discourse, ascribed to Odin himself, in which he has delivered admirable precepts to his followers, is the only thing of the kind in existence, and contains profound maxims of wisdom:

> "Which skalds of old have spoken since, in lays of Havamaal:
> From race to race descended deep, those sayings fraught with doom,
> And Norway still reveres the same, as voices from the tomb."

The religion of Odin carried with it an innumerable quantity of mythic poems and sagas, and the skalds, or scops, who sung and chronicled these traditions, thus possessed of a mythology so propitious to poetic fiction and ornament, were celebrated throughout the north of Europe: they visited other countries, resided amidst the splendour of courts, and were enriched and caressed by the greatest monarchs of their time. The dawn of northern literature—the only literature which Europe can boast anterior to the adoption of Christianity—is, in short, inseparably connected with the northern superstitions, and the sagas in which they are preserved, must ever remain the earliest monuments of Gothic intellect. So rich a mine has not been neglected by modern writers among the Danes, Swedes, and Germans; many a beautiful creation of genius owes its existence to this source, as the German reader well knows, and the works of Gray, Cottle, Sayers, and especially Herbert, prove that the English are not insensible of the beauties of the northern mythology.* But for the artist, to whom these remarks are addressed, it remains an almost unexplored region of magnificent and poetic fable, which may challenge competition with any which the ingenuity of man has invented. As an instance, it would be impossible to select a more poetical creation of fiction than that of the Walkyriae,—those beautiful, but terrible emissaries of Odin, seen by the dying Scandinavian hero only during his last agonies upon the field of battle, and there upholding his courage

[1] [We are obliged to postpone Plate V, a perspective view of the interior, until next month.—ED.]

* Among these should be mentioned also the translations of Tegneris Frithoff, especially that by Mr. Latham.

to the last, and cheering the dark hour of death by visions of the Walhalla, to which they were come to conduct him.

These beautiful and warlike maidens play an important part in the paradise of heroes, and have been accordingly introduced by Klenze in the building under consideration. Their name, Walkyriae from two Icelandic words, signifies choosers of the slain, as Walhalla means the hall of the slain. Their office was to receive the souls of those warriors who were deemed by Odin worthy of immortal reward, and conduct them to his palace of Walhalla. Led by his beautiful guide, the shade of the hero passes over the bridge of the gods, the rainbow, called Bifrost, which is guarded by the sentinel Heimdal, and they enter the celestial city Asgard, surrounded by ever blooming trees, and full of gold and silver palaces, the mansions of the gods of the Edda. Above this city lies Gladsheim: and here, surrounded by a grove whose trees bear golden leaves and fruit, is situated the promised Walhalla. The hero and his guide approach the western gate, upon which the magic bolt Walgrind, which excludes all unconsecrated souls, falls, and his future residence lies before the hero in all its glittering splendour: gold and silver, brightly polished shields, armour, and weapons, and all the paraphernalia of barbarous warfare, appears on all sides. The Einheriar,—the name given to the future inhabitant of this glorious abode,—upon his entrance, is presented by his guardian Walkyria with his installation cup of mead, Iduna, the goddess of youth, offers him the apples of immortality, and he is at once recognised by his former companions in arms, who have gone to Walhalla before him, with loud shouts of greeting,—"Welcome, Einheriar! enjoy peace and drink mead for ever with the gods!" the future life of these heroes, notwithstanding this reception, is neither an idle or peaceable one. Fighting was an indispensable amusement with our forefathers even in the abodes of bliss. Fighting was their business and pleasure upon earth, and, according to all savage ideas of a future state, they expected to repeat again their earthly pleasures in heaven. Hence arose the custom among the Scandinavians when a chief fell gloriously in battle, to burn with him upon the pyre his armour, sword, and war horse, and whatever else he held most dear. His dependents and friends frequently made it a point of honor to die with their leader, and attend on his shade in the palace of Odin. In the tomb of King Chilperic were found his arms and the bones of the horse on which he supposed he should be presented to the warrior god in Walhalla. A singular instance of this custom has been recently discovered upon opening three tumuli near East Ilsley in Berkshire. In the graves were found skeletons of gigantic persons, together with warlike weapons, rude articles of military equipments, and the bones of animals, probably horses. These persons had evidently fallen in battle, the skulls being fractured, and an iron javelin head being firmly fixed in one of the hip bones.

The pastimes in Walhalla were therefore in accordance with this superstition. In the morning, at the crowing of the golden cock Fialar, the heroes arise with one accord, buckle on their armour and weapons, mount their war steeds, and sally out of the 540 gates of the Walhalla.

> "Fünfhundert Thuren und noch vierzig
> Glaub'ich dass in Walhall sind—
> Alle Einheriar in Odin's Gehege
> Hauen sich jeden Tag;
> Tod kiesen sie und reiten vom Kampf.
> Trinken Bier mit den Asen und speisen Sährimner,
> Und sitzen einträchtig zusammen."
>
> —*Rüh's Edda.*

They ride to a mighty plain called Odinstun, and here they fight together with all the fury of their mortal days, performing miracles of bravery until the god Heimdal sounds his horn, upon which their wounds are miraculously healed, and they return amicably to the banquet in Walhalla, the bravest of the day being rewarded with the most distinguished places at the board. Their food consists of swine's flesh, from the hog Sährimner, which is never consumed, and hydromel, is supplied by the beautiful Walkyriae, whose duty it is to attend upon them, the gods and Odin himself being present at the banquet.

It should be observed, that warriors of mean birth, and slaves, though dying bravely and in battle, were not admitted to the mansion of Odin; but were received into the palace of Thor, in Bilskirner: noble women were assigned a residence in Folkvang, the palace of the goddess Freia. The unwarlike, and those who had the misfortune to live all the days of their lives,—a calamity which the Scandinavians avoided by voluntarily destroying themselves,—were condemned to an abode in Niflheim, the icy domain of the infernal goddess Hela, from whose name is derived our word hell.

These are the principal features of that portion of the northern mythology which has furnished an appropriate name for a monument to the honor of the illustrious sons of Germany. It might be wished that the architecture of this splendid building had shared in the spirit of nationality of which in all other respects it is so characteristic; or at least that it had been more original in design. But as far as regards the exterior, it can claim the merit only of being an excellent restoration of the Parthenon: the architect has made more than ample atonement for rejecting the mythology of the Greeks by most scrupulously following their architectural model. For this want of invention he seems quite willing to hold himself responsible, by stating that, though the Grecian Doric order was recommended, he was left to the free exercise of his judgment in every other respect. I am, notwithstanding, inclined to suspect that the hint given to the competing architects in the original instructions—to the effect, that an imitation of some approved model of antiquity would be preferred to a less beautiful, though more original invention—influenced him more than he chooses to confess.

The enormous substructure of masonry and large "step-like plinths" upon which the temple is elevated appears to be an injudicious arrangement: it has the effect of making the principal object, the building itself, appear insignificant compared with its subordinate pedestal. The effect must not be judged, however, from a geometrical elevation; for it must be remembered that the building stands upon a considerable eminence, and that the consequent forshortening, when seen from below, must in a great measure obviate this objection.

The arrangement of the interior is very skilful, and in many respects original. The task of introducing a method of roofing unknown to the Greeks, but designed in the spirit of their architecture, was a difficult one, and is well overcome. The roof is of cast iron, of which the construction is visible, leaving open spaces glazed for the admission of light, and by means of sculpture rendered highly ornamental.

The division of the hall by the projecting masses, or wings, which originate in the necessary support of the roof, is a disposition which produces animation and a play of light and shade, and also increases the apparent extent of the building. These wings boldly projecting from the side walls, break the monotony of the simple parallelogram form of the plan, and always conceal a portion of the busts which occupy the lower range of walls, and which, from their great number and similarity, would otherwise have become wearisome. The upper portion of the side walls is visible the entire length, interrupted only by the beautiful Walkyren caryatides which form the principal ornament of the interior, and upon which the eye of the spectator first rests.

The temple, exclusive of the substructure, incloses a space of 234 ft. in length and 107 ft. in breadth, surrounded by 52 Doric columns 31 ft. high and 5 ft. 10 in. diameter. The internal length, including the opisthodomus, is 171 ft., the breadth 92 ft., and the greatest height 53 ft. 5 in. Height of the lower order, 28 ft. 5 in.; the upper order, 17 ft. 5 in.; and the caryatides, 10 ft. 5 in.:—height of the temple outside to the summit of the pediment, 61 ft. The substructure is 106 ft. high, 236 ft. in breadth, and 425 ft. in depth. From the level of the Danube to the summit of the temple is 304 ft.

The following description is abridged from the work published by the architect, Leo von Klenze:—

"In February of the year 1814 there appeared in the public papers an invitation to German architects, to prepare designs for the monument which his Royal Highness the Crown Prince of Bavaria proposed erecting to the great men of Germany. The plans produced by this invitation were not satisfactory to his Royal Highness, and I was commissioned to prepare the drawings which have formed the basis of the present design.

"Ratisbon,—a city famous in the history of Germany and Bavaria, and one of the uniting points of the grand roads of Germany, situated upon one of the principal rivers, and in a charming country diversified by valley and mountain, and in a mild climate favourable to building,—Ratisbon was the place chosen by the king as the site of the future Walhalla.

"The 18th October, 1830, the anniversary of that battle which freed Germany from a foreign yoke, was the day appointed for laying the first stone of the edifice. The ceremony was performed by the king in person, and an eloquent oration was pronounced by Edward von Schenck. 'Since civilization and education have been naturalized in Germany,' said he, 'many glorious buildings have been erected; for centuries together has the most persevering art been often employed upon the perfection of a single cathedral. Our country is filled with churches, palaces, fortresses, and castles, and modern times have seen the erection of halls and temples not unworthy of the very father-land of the arts. Statues also, and monuments have been raised to individuals; but since the earliest period of our history Germany has never till now erected an universal monument to her mighty sons. The project of erecting such a monument was reserved for King Louis of Bavaria, and never lived a monarch more worthy to carry such a design into execution.'

"'Let us now,' continued von Schenck, 'look with prophetic eye to the completion of the Walhalla, and contemplate the building as it will one day appear upon the eminence whereon we now stand. What a prospect for the traveller who approaches from the shores of the Danube! Upon the summit of this mountain he will behold a mighty temple of white marble, a hall worthy of the glorified heroes, resting upon mighty Doric columns, embanked by cyclopeian walls and terraces, and approached by extensive flights of stone steps.

"'Having ascended these steps, the sculptured pediment above reminds him of the conquest of the Romans by the Cherusei, and other early battles of the German people. He enters the temple, and his first glance falls upon a sculptured frieze which surrounds the walls, representing the religion, customs, battles, and commerce of the aborigines of Germany. Beneath this frieze, and all around him, he beholds the busts and glorious names of those men who have immortalized our father-land in every branch of art and science, and on every public occasion. The series of these great men commences with those ancient heroes whose primordial efforts broke the mighty power of Rome: to them follows the race of Pepin of Heristhall, the line of noble and mighty emperors of Saxon and Frankish race, the Hohenstaufen, and the race of Habsburger.

"'The line of emperors is closed by those great and good princes who have governed in their own separate countries, or in foreign lands,—such as Otho and Maximillian of Bavaria, Amalia of Hessen, William of Orange, Frederick of Prussia, &c.

"'These monarchs are surrounded by the great men who have been their contemporaries, and who have lived and died for faith and truth, for fame and freedom, or for science and art. Heroes from the Cherusker Hermann, who conquered the Romans, down to Schwartzenberg and Blucher; holy men, like Nicholas von der Flue and Thomas à Kempis; philosophers, as Leibnitz and Haller; Germany's early poets, from the author of the renowned Nibelungen Lied down to Schiller; (long may the bust of Goethe remain in the Hall of Expectation[2]) the heroes of plastic art, from the old masters down to Mengs; and, last of all, the mighty Dioscuri of German melody, from Gluck to Mozart.'

"[2] Goethe has passed the ordeal which entitles the hero to admission within the halls of Walhalla; his bust will now be found among the best.—T.

"'I can believe,' concluded Von Shenck, 'that the spirits of these great men are now at this auspicious moment hovering around us in gratitude to the noble king who raises this monument to their merits. Their blessing will not be in vain: it is joined to that of Heaven, and descends already upon this building.'

"'While in many other—alas! also German—states, sedition and mistrust threaten to loosen the holy bands between prince and people, here, in Bavaria, stands her king: happy, because he diffuses happiness and prosperity, mighty in the love of his people, justly estimating his high calling, and with conscious power steadily fulfilling it. And thus he lays the foundation stone of a monument to German greatness and German truth.'"

On the conclusion of this oration, the king, standing beneath a baldaquin, supported by columns and surmounted by a statue of Germany, proceeded to lay the first stone of the Walhalla, and the building was commenced in the spring of 1831.

The first large division of the terrace is of Pelasgic construction, and of polygonal blocks of a marble-like limestone; the second division, and likewise the three large step-like landings below the temple, are of the same stone, and formed of regular blocks, but of unequal height and length, as is found in many buildings of the Greeks,—as in the walls of Kalidon, and also in the Theatre of Marcellus in Rome. The columns are 5 ft. 10 in. in diameter, and formed in eleven blocks.

The severe style of the exterior architecture is relieved by the sculpture in the pediments, consisting of highly relieved groups in white marble, by the hand of Schwanthaler, from designs made by the king. The first illustrates the battle in Teutoburger Walde, under the victorious Armenius: the second represents Germany, to whom, after the catastrophe of 1813-14, the representatives of the united forces are presenting the lost provinces.[3]

The site was so chosen that the south end of the temple should present the principal entrance and access for those on foot. In ascending, by means of the different steps and terraces, first to the right and then to the left, the building and prospects of the distant country are presented to the visitor under various and continually changing points of view. Having arrived by 140 steps at the second terrace, a bronze door is seen, which leads to an arched chamber. This chamber is termed the Hall of Expectation, and is intended for the reception of busts of great men still living, from whence, when the occasion arrives, they are removed into the Walhalla itself. Two other flights of steps lead to the pronaos and principal entrance of the temple.

The arrangement of the interior demanded all possible space for the reception of the busts, and their proper distribution was a leading feature of the design. It was necessary that the busts should be all of equal size, and of the Greek therm form; and also, in order to typify the universal equality of all in Elysium, that they should be placed in rows according to their dates only, without individual distinction.

It was then essential that the monotony of the *coup d'œil* of so many similar sized heads should be got rid of. The construction of the roof, which of course could not be left open like the ancient hypethral temples, and which therefore required supporting beams, sustained by four projecting masses from each longitudinal wall so as to lessen their span: this form offered the best means of avoiding the objectionable repetition; and it was thus attained, namely, that in a general view along the hall, a large proportion of the busts would be always concealed from the spectator by the projecting architectural masses. At the extreme end is a large gallery, and in each longitudinal wall a passage introduced, both which during an inauguration or other ceremony, serve for the accommodation of spectators. In designing the building, the architect always had in view the celebration of some solemn and poetic ceremony, as for instance, that certain pe-

[3] Professor Rauch made the original model for this sculpture to a small scale. The execution of it was afterwards entrusted to Schwanthaler, who was then rising into fame. He remodelled the design, and deserves the credit of the entire work, which is of the highest order.

riodical national associations should be held, having for a principal object, the admission of a new bust, and the solemn inauguration of a new hero to the halls of the Walhalla. On such an occasion a processional train would ascend the steps to the first terrace. Here the inaugural bust would be taken from the Hall of Expectation, which would be appropriately decorated for the occasion, and from thence be borne in procession to the next terrace, and so carried into the temple. Upon opening the great bronze doors the procession would be received by a chorus of singers, who would remain unseen in the gallery. Spectators would be permitted only in the gallery and passages, and the hall remain consequently quite free for the train, which would proceed in choragic order to the place appointed for the reception of the bust.

It was important that the interior decoration should tend to promote in the spectator the frame of mind which the foregoing ceremony had awakened, and therefore it was the desire of the accomplished founder of the Walhalla, that the aid of rich descriptive sculpture and ornament should be called in as the most effective means of so doing. In the mythology of our forefathers the Walkyriae were beautiful maidens, whose duty it was to bear dying heroes from the field of battle to the palace of Odin, there to be entertained with never-ending banquets, and to dwell for ever in the paradise of the valiant.

Statues of these beautiful companions of the beatified German heroes, have been employed as caryatides, to avoid the multiplication of severe architectural forms, which are apt to produce mechanical plainness, and also, in order to relieve the monotony produced by so large a number of busts. These Walkyren caryatides, sculptured in marble by L. Schwanthaler, are habited, as near as is known, in the ancient German costume, and are employed to support the cornice and roof. The heroes of the Walhalla are necessarily divided into two classes, namely, those who from the want of existing portraits are recorded only by name, and those of whom busts are really extant. To the first of these is allotted the upper division of the inner compartments of the walls, and their names are inscribed in the spaces between the fourteen caryatides. The busts in a double row, partly upon a continued pedestal, partly upon projecting marble bearers, are divided into six classes, over each of which presides a female therm-shaped statue, sculptured by Rauch, and having reference to the class over which she presides.

In order to complete the allegorical sculpture, the interior pediments formed by the horizontal beams, and the sloping roof, are enriched by three sculptured bas-reliefs, in which are represented the three principal epochs of the northern mythology. In the first is seen the giant Ymer, born of the moisture engendered by the hot wind from Muspelheim and the cold mists from Nifelheim, and from his shoulders spring the first human beings, Askar and Embla. Near him are the Lord of Muspelheim, Surtur the god of light and warmth, and Hela the goddess of Nifelheim. Foliage of the ash and elm * fill up the angles of the pediment. In the second pediment appear the principal inhabitants of Asgard; Odin with his spear Gugner, and Frigga with her golden spindle, seated upon their throne Lidskjolf; on the right is Thor with his terrible hammer Miolner, striking the Roman eagle to fragments, and Baldur the youthful god of Eloquence. On the left Braga the god of wisdom and poetry with his goddess Iduna, who, like the Greek Hebe in Olympus, presents the heroes of the Walhalla with the golden apples of immortality. The ravens of Odin fill up the angles. The centre of the third pediment is filled with the mighty ash tree Ydrasil, on the summit of which the eagle of Odin spreads his wings. Beneath the roots flows the fountain of wisdom, with which the tree is watered by the three Nornies. In the angles are the squirrels Rotatoskr.

Beneath this and between the upper and lower orders, is introduced a large bas-relief in eight divisions, which, according to the command of the royal founder of the Walhalla, illustrates the history of the German nation from its earliest period to the introduction of Christianity, and was designed and executed in white marble by Martin von Wagner in Rome. This admirable work, 224 ft. in length and 3 ft. 6 in. high, embraces the following eight principal events. 1st. The peopling of Germany by settlers from the east and the Caucasian countries. A mighty train, in long procession, of wild but beautiful forms, preceded by warriors, followed by their wives and children, and closed by shepherds, are represented passing the river Ister, and engaged in subduing the bear and wild boar, the sole inhabitants of the forests of Germany. In the second division is represented the religion and occupations of our ancestors. In the midst a religious ceremony is being solemnized under a large oak, and horses are being offered in sacrifice. Bards are chaunting the mysteries of the religious rites; and a troop of young warriors is impatiently awaiting the completion of their shields, which an artist is employed in decorating. The third division represents the political and commercial doings of our ancestors; the choice of a leader, the first council of the chosen king with his people, and the intercourse and commerce of the Phœnicians with the northern nations. In the 4th, 5th, and 6th, are represented the contests between the Germans and the Roman empire. In the 7th, the conquest of Rome by Alaric; and the introduction of Christianity by the fervent preaching of the holy Boniface, in the 8th division, concludes the bas-relief.

* These were sacred trees.

Respecting the ornament employed, it may be remarked, that without abandoning the long sanctioned Greek contour of form, the architect has employed foliage of German growth, assimilating it as far as possible with the Greek character.

As the adoption of classical architecture was expressly enjoined in the instructions for the edifice, it became necessary to follow what is believed to have been the practice of the Greeks, and unite the charm of colour to that of form. But the architect considers that the striking means which the Greeks employed to distinguish the outlines of their mouldings and members, rendered beautiful and necessary beneath the brilliant skies of Greece, on account of the clearness and light of their atmosphere, is not admissible on external architecture in a northern climate. The interior lithochromic decoration, is as follows: In the ceiling, those parts of the metal construction which are visible, are entirely gilt. The coffers of the ceiling, as well as the soffit of the beams, are coloured azure, and ornamented with stars of white gold or platina, with which, also, all rosettes, screw heads, and fir cones used in the construction are covered. The mouldings of the coffers and panels are likewise gilt and ornamented with coloured foliage. The sculpture and ornamental foliage which fill up the pediment shaped supports of the roof, are pierced and open, and of light form, that they may not appear to overload this essential part of the construction. They are partly of white and gold, and partly coloured after the manner of classic sculpture. The carved members of the cornice of the upper order, which is of white veined marble, is also partly gilt and partly coloured. The frieze is azure, with oak wreaths of bronze gilt. The upper division of the walls is of a reddish brown marble, from the quarries of Oberfranken: the inscription tablets of white marble, the letters of gilt bronze. The Walkyren caryatides of marble of the Danube are entirely but very faintly coloured. The parts representing flesh are ivory colour, the hair fair brown, the bear skin mantle entirely gilt, the upper dress bright violet, the under robe white. The plinth upon which the figures stand is of a warm grey Lumachelli marble; the entire entablature, and the long bas-relief, in the frieze, is of white marble, part from Schlanders, part from Carrara. The carved architrave and cornice are brought out in colour and gold, the relief quite white, and the ground of the ornaments in the frieze azure. The lower division of the principal walls, as well as the pilasters and shafts of the columns, are of brownish red marble from Admet, resembling the antique African. The caps and bases of the columns and pilasters are of white marble, ornamented with colour and gold. The carved bearers of the busts, the busts themselves, and the six presiding statues, together with all cantilevers and seats constituting the furniture of the hall, are of white marble without colour or gilding. As the busts could not with propriety have been coloured, it would have been prejudicial to them to have employed gilding or colouring in the sculpture of which th orm a

part. The continued pedestal upon which the first row of busts stands, is of a beautiful yellow marble, from Weltenburg, on the Danube; the plinth is white. The architraves of the doors and windows are of white marble, with ornaments of colour and gold. The doors, plated with bronze externally, are towards the interior, of maple, with studs, and inlaying of bright red amazanth wood.

The floor consists of a variety of marbles, following in pattern the general plan of the interior, and was worked and polished in the manufactory at Tegernsee. In the centre fields are three tablets, upon which, in black letters, upon a white ground, are the following inscriptions: "Projected in January, 1806; commenced October 18th, 1830; finished October 18th, 1842."

Inscriptions on the Tablets.

Herrmann, Conqueror of the Romans	21
Marobod, Chief of the Markomanni	40
Velleda, Prophetess	65
Claudius Civilis, Leader of the Batavians	100
Herrmannrich, King of the east Goths	375
Ulphilas, Bishop	380
Friediga, Leader of the west Goths	380
Alaric, King of the west Goths	410
Ataulf, ditto	415
Theodorich, ditto	451
Horsa, Conqueror of Britain	451
Genserich, King of the Vandals	477
Hengist, Conqueror of Britain	480
Odoaker, King of the Herulii and Rugii	497
Klodwig, King of the Franks	511
Theodrich, King of the east Goths	526
Totila, ditto	552
Alboin, King of the Lombards	573
Theutelinde, Queen of the Lombards	626
Emeran the Holy	680
Pipin of Heristall, Duke of Austrasia	714
Beda the Venerable, Abbot and Historian	735
Willibrod the Holy, first Bishop of Utrecht	739
Charles, Duke and Prince of the Franks	741
Bonifacius the Holy, Archbishop of Mainz	755
Pipin the Short, King of France	768
Wedekind, Leader of the Saxons	800
Paul Warnerfied, Historian	800
Alcuin, Abbot and Philosopher	804
Egbert, King of England	810
Charles the Great, Emperor (Charlemagne)	814
Eginhard, Historian	839
Rhabanus Maurus, Bishop and Philosopher	856
Arnulph, Emperor	900
Alfred the Great, King of England	900
Otto the Enlightened, Bishop of Saxony	912
Arnulph, Duke of Bavaria	937
Machthildis the Holy, Queen of Germany	968
Roswitha, Poetess	1000
Bernward the Holy, Bishop of Hildesheim	1022
Heirbert, Archbishop of Cologne	1028
Henry III. Emperor	1056
Lambrecht of Aschaffenburg, Historian	1077
Otto the Holy, Bishop of Bamberg	1139
Otto, Bishop of Freysing, Historian	1158
Hildegard the Holy, Abbess	1179
Otto the Great of Wittlesbach	1183
Engelbert the Holy, Archbishop of Cologne	1225
The Poet of Nibelunger Lied	
Walther of the Vogelweide, Minnesanger	1230
Elizabeth the Holy, Laudgravine of Thuringen	1231
Leopold VII the Glorious, Duke of Austria	1234
Hermann of Salza, Master of the Teutonic Order	1240
Wolfram of Eschenback, Minnesänger	1251
The Architect of the Cathedral of Cologne	
Arnold of Thurn, the Founder of the Rhenish League	1264
Albertus Magnus, Bishop of Regensburg	1280
Walther Fürst, Werner Stauffacher, Arnold of Meshthal, The three men of Rütli	
Friedrick the Handsome of Austria	1330
Bruno of Warendop, Hanseatic Leader	1369
Arnold Strutthahn of Winkelried, Knight of Unterwalden	1386
Wilhelm of Cologne, Painter	1388
Hadrian of Bubenberg	1479
Peter Henlein, Inventor of Watches	1540

List of Busts at present placed in the Walhalla.

A catalogue of the individuals who have, in the first instance, been selected as worthy representatives of the genius of the German nation, will doubtless possess interest for many, nor the less on account of its indicating a very different estimate of worth and celebrity, from what would be looked for by ourselves. While many of the characters that have been selected for such honour, are scarcely known at all in this country, others who are here looked upon as first-rate German celebrities, do not appear. It is true not much more than half the intended number of busts have yet been executed, but those which remain to be added, are exceedingly few in comparison with the host of claimants for distinction. Among artists, Schinkel will almost of certainty be elected; as to Klenze, even when the time shall arrive for his being admitted into the company of illustrious worthies, such compliment may be deemed superfluous in his case, inasmuch as the Walhalla itself constitutes a sufficient monument of his talents and his fame.

	Date of Death.	Sculptor.	Date of Bust.
Heinrich der Finkler, King	936	Schadow	1821
Otto der Grosse, Emperor	973	Ditto	1821
Konrad II, Emperor	1039	Ditto	1810
Friedrich I. der Rothbart (Barbarossa) Emperor	1190	Schwanthaler	1835
Heinrich der Löwe	1190	Schadow	1821
Friedrich II, Emperor	1250	Ditto	1821
Rudolph von Hapsburg, King	1291		
Erwin von Steinbach (architect of Strasburg Cathedral)	1318		
Eberhard, Duke of Wurtemberg	1445		
Joh. Guttenberg, inventor of printing	1467		
Joh. von Eyck, painter	1475	Rauch	1834
Friedrich der Siegreiche	1476	Lossow	1842
J. Muller (Regiomontanus)	1476		
Nikolaus von der Flue	1487	Tieck	1814
Hans Hemling, painter	1500	Woldeck	1841
J. von Dalberg, Bishop of Worms	1503	J. Henmann	1840
Berthold von Henneberg	1504	Mayr	1821
Hans von Hallwyl	1504	Christen	1812
Maximilian I, Emperor	1519	Kauffmann	1801
Reuchlin	1522	Imhof	1835
Franz von Sikingen	1523	Boudel	1823
Ulrich von Hutten	1523	Kirchmaier	1811
Albert Durer, artist	1528	Rauch	1837
Georg von Freunsberg, field officer	1528	Widnmann	1841
Peter Visscher, the elder, artist	1530	C. Muller	1831
J. Turmayr, historian	1534	Horchler	1841
Walter von Plettenberg	1535	Schwanthaler	1831
Erasmus	1536	Tieck	1813
Theophrastus von Hohenheim (medical)	1541	Wolf	1827
Kopernicus, astronomer	1543	Schadow	1817
Hans Holbein, artist	1554		
Karl von Kaiser	1558	Schwanthaler	1841
Christopher, Duke of Würtemberg	1568	Bissen	1831
Ægidius Tchudi, historian	1572	Tieck	1817
William, Prince of Orange	1584	Ditto	1815
Augustus I, Elector of Saxony	1586	Ritschel	1840
Jul. Echter von Mespelbrunn, Bishop of Wurrburg	1617	Scholl	1840
Maurice, Prince of Orange	1625	Tieck	1814
Kepler, astronomer	1630	Schopf	1842
Wallenstein, warrior	1634	Tieck	1812
Bernhard, Duke of Saxe Weimar	1639	Ditto	1812
Rubens, artist	1640	Mannheim	1809
Vandyk, artist	1641	Rauch	1812
Hugo Grotius, philosophy	1645	Tieck	1814
Maximilian von Trautmannsdorf	1650	Schaller	1804
Maximilian, Elector of Bavaria	1651	Imhof	1812
Amalia Laudgrafin von Hesse	1652	Tieck	1817
Von Tromp, Admiral	1653	Kessels	1825
Lodron, Archbishop of Salzburg	1653	C. Eberhard	1814
Snyders, painter	1657	Rauch	1814
Charles IX. of Sweden	1660	Tieck	1816
Von Schonborn	1673	Ditto	1818
Ernest, Duke of Saxe-Gotha	1675	Ditto	1815
De Ruiter, Admiral	1676	Ditto	1817
Otto von Quericke, inventor of air pump	1684	Rathgeber	1811
William, Elector of Brandenburg	1688	Wichmann	1818
Zinzendorf	1702	Tieck	1808
William III. of Great Britain	1702		
Ludwig, Margrave of Baden-Baden	1707	Widnmann	1841

Leibnitz, philosophy	1716	Schadow	1808
Boerhaave, medicine	1732	Leeb	1823
Moritz von Saxe, warrior	1750	Tieck	1813
Handel, musician	1753	Schadow	1810
Count von Munich, Russian Field-marshall	1767	Lossow	1841
Winckelmann, antiquary	1768	Schadow	1814
Count von Schaumburg-Lippe	1777	Ditto	1809
Von Haller, poet, &c.	1777	Ditto	1808
Mengs, artist	1779	Rauch	1808
Maria Theresa, of Austria	1780	Eberhard	1811
Gluck, musician	1787	Dannecker	1812
Von Loudon, Field-marshall	1790	Kissling	1813
Mozart, musician	1791	Schwanthaler	1840
Ferdinand, Duke of Brunswick	1792	Schadow	1808
Justus Moser	1794	Schmid	1821
Burger, poet	1794	Tieck	1811
Catherine II. of Russia	1796	Werdo	1831
Klopstock, poet	1803	Schadow	1808
Heinse	1803	Haller	1826
Herder, poetry and philosophy	1803	Tieck	1815
Kant, philosophy	1804	Schadow	1808
Schiller, poetry and history	1805	Dannecker	1794
Haydn, music	1809	Robotz	1810
Joh. von Muller, history	1809	Schadow	1808
Wieland, poetry and belles lettres	1813	Ditto	1807
Scharenhorst, Field-marshall	1813	Rauch	1830
Barclay de Tolli, ditto	1818	Widnmann	1841
Blucher, ditto	1819	Rauch	1817
Prince Schwartzenburg	1820	Schaller	1821
Herschel, astronomy	1822	C. Eberhard	1816
Diebitsch-Sabalkansky, Field-marshall	1831	Rauch	1830
Stein, Prussian Minister	1831	Leeb	1825
Count von Gneisenau, Field-marshall	1831	Tieck	1842
Goethe, poetry and universal literature	1832	Ditto	1808

A CHAT ABOUT WESTMINSTER ABBEY.

Our metropolitan minster (*not* of St. Paul's), is perhaps without exception, the most beautiful, interesting, and instructive sight in London; and yet how many inhabitants of this great city are there who, but for the accidental visit of a country cousin, which led them to seek the Lions, had never seen it? and how many more to whom it is still unknown ground? They have travelled, perhaps, to York, to see the Minster there; they have sought objects of interest at Cologne; they have thrown their eyes round the Cathedral of Strasburgh—but Westminster Abbey, close at home, has escaped their investigating gaze. Let them lose no time in seeking it out. We feel persuaded that few can visit this wonderful museum of skill, genius, noble thoughts, and memories of good deeds, without an elevation of mind, an improvement in taste, and a chastening in feeling which must tend in a greater or less degree to good. Walk through it, examine it, study it, as often and carefully as you may, you will ever find some fresh claim on your attention, some beauty before overlooked, or some evidence of unpretending piety, which makes you prouder of humanity and more determined to do nothing derogatory in your own person. It is, indeed, a spot "where folly's dancing foam melts if it cross the threshold;" where thoughts that are unholy die; where the past great ones of six centuries speak powerfully to you—it is to be hoped, not uselessly.

The multitude of monuments which it contains, from that of King Henry III, upwards, (omitting, for the present, any remarks on the destructive effect produced by those erected in modern times,) render it an index to English history, and a commentary, while the specimens of the workmanship of different epochs in wood and stone, and glass and metal, which these and other portions of the building present, make it a lecturer on British art and a record of its progress. Edward the Confessor's chapel, at the east end of the choir, is alone a sufficient reward for a pilgrimage of a hundred miles. Here, where old Time seems to have secluded himself from the garish present, and reigns over remnants of the past, are ranged memorials of our early sovereigns—the pious Edward, Queen Eleanor, Edward I, Henry III, Queen Philippa, Richard II and his Queen, and the gallant Henry V. It has nothing in common with the present time, it stands alone, and cannot be realized in the mind of any one of the thronging thousands, who are passing at so short a distance from the spot, if they have not visited it. Examine the pavement, examine the shrines—the chantry of Henry V, the screen, next the choir covered with minutest sculpturing—and see how the powers of art *have* been lavished in honour of God. Our forefathers were not satisfied with the decoration of the mere face of the part in human sight—the highest exercise of their powers was deemed hardly worthy of the temple, and so long as any portion, however remote, or hidden, remained capable of improvement, so long was it deemed incomplete and requiring alteration.

Of the elegance of the Abbey as a structure it is almost needless to speak: it may be termed the finest example of the pointed style of architecture ever executed in England, and remains the most complete, with the exception of the cathedral at Salisbury. The combinations which its various parts form, especially at the eastern end, are as numerous as they are striking, and serve to impress a strong conviction on the mind, of the skill of the old builders, and the power they possessed of so arranging their structures as to excite pleasurable and lofty emotions. Amongst the most striking of these combinations is that presented when standing beneath the porch of Henry VII's chapel, the gloom in which, most artistically devised, serves to render the full flood of light, to be found in the chapel itself, striking and effective in the highest degree. Burke remarks, in his essay on the sublime, "I think that all edifices, calculated to produce an idea of the sublime, ought rather to be dark and gloomy; and this for two reasons; the first is, that darkness itself, on other occasions, is known by experience, to have a greater effect on the passions than light. The second is, that to make an object very striking, we should make it as different as possible from the objects with which we have been immediately conversant; when, therefore, you enter a building, you cannot pass into a greater light than you had in the open air: to go into one some few degrees less luminous, can make only a trifling change; but to make the transition thoroughly striking, you ought to pass from the greatest light to as much darkness as is consistent with the uses of architecture." This the architects of the middle ages well understood; they appreciated the "dim religious light," and accordingly built their ecclesiatical edifices, for the most part, with comparatively few openings. When, however, as in the case before us, the style adopted rendered larger windows necessary, they reversed the arrangement, and so still obtained the required effect. In a Gothic edifice, nothing was done without intention—everything is meaning-full, design is everywhere apparent.

Many of the striking combinations, to which we have referred, are now sadly interfered with by the modern monuments, with which the Abbey is lumbered up—monuments for the most part so absurd that they would make us laugh if they did not make us sad. Mouldings, pillars, and adornments of all descriptions have been ruthlessly cut away for them, openings have been interfered with, and even several of the spaces between the large clustered columns in the side ailes and chapels, are blocked up to the top with tasteless and incongruous masses of stone and marble, alike unsuitable and discordant in colour and design.

The sculpture of the best periods of the middle ages has an entirely distinct and original character, prompted by the spirit of the time and carried out by genius. It is in no way imitated from the master-pieces of Pagan art, which might have been used as models; but is nevertheless full of feeling, and appeals to the sympathies rather than to the eye. In the ancient tombs at Westminster as elsewhere, the sculpture is seen to be a portion of the building, conceived in the same spirit and displaying the same feeling of reverence. All the figures are in repose, all are devotional—there is no flutter, no action even, certainly no worldly action; they do not seek to record, in vain self-glory, any moment of the past, but carry us forward to the great hereafter, and inculcate humility. Alas! how sadly this contrasts with those of more recent date, where every man "for his own hand," has worked in his own way, careless of the general effect, and has not worked well. Mountains of most *material* clouds,

urns, flames, figures in ill conceived and violent momentary action, accurate models of periwigs and whiskers, the evanescent fashions of a period of universal bad taste, form the staple—but why endeavour to prove what nearly all seem to acknowledge? A few weeks ago, when the writer said at the Institute of Architects, in reference to the tasteless tombs and monuments with which our cathedrals and churches have been gradually encumbered and overladen, "Like some frightful fungus, they have spread insidiously over all parts of these structures, destroying alike their beauty, propriety, and stability. Our metropolitan Abbey presents a lamentable example of the evil; and it is to be hoped that the acknowledged good taste of those who now govern there, will not merely prevent the increase of this abomination, but lead, as opportunities may from time to time offer themselves, to the removal of the excrescences now deforming that fine building, and to a restoration of its harmonious proportions and original integrity;"—the meeting at once recognized the existence of the evil and reiterated the desire for an alteration. Again we venture to re-urge it. The triforium might be made to contain many of the monuments, as has been done at the Temple Church. Perhaps, too, the Chapter House, which is about to be cleared of its present contents, (dirty shelves and presses,) could receive some without injury to itself, so as gradually to restore to our venerable Abbey its original appearance.

The present state of the ancient monuments is deplorable, and requires immediate attention. Mr. E. Blore, the architect of the Dean and Chapter, when before the Committee of the House of Commons on national monuments, in 1841, said, that he considered these monuments very sacred things, not to be touched without great care and consideration, as more harm than good might be done in attempting to improve their appearance. This is quite true, but there is nevertheless a limit to that forbearance, and this limit has been reached; for unquestionably, unless some steps be taken at once in several cases, nothing will remain to guide the restorer hereafter, and an irretrievable loss will be sustained. We should be right glad to see a general and perfect restoration commenced, a restoration which should include the removal of the ugly western towers put up by Wren, (who knew little of Gothic architecture, and liked it less,) and the completion of the central tower or spire. Some partial repairs and alterations are indeed contemplated, and the plans have been prepared: let us most strenuously urge on the new Dean, Dr. Turton, if it may be done without apparent impertinence, the importance of energy in such a matter as this, and the necessity for the greatest vigilance, in order to prevent not only the occurrence of fresh injuries, but the perpetuation of those already committed.

Amongst the earliest improvements to be made in the Abbey, is the introduction of stained glass in the rose-window and twelve lower openings of the south transept. The execution of this work, after two competitions, was entrusted to Messrs. Ward and Nixon, and is making rapid progress. The subjects for the twelve lower windows are taken from the Old Testament, and may be described as, Noah's sacrifice, Abraham and the angels, Jacob's dream, Joseph interpreting Pharoah's dream, the finding of Moses, Moses before the burning bush, Moses striking the rock, Moses with the tables of the law, David anointed by Samuel, dedication of the temple by Solomon, Elijah's sacrifice, and Josiah renewing the covenant; the figures are the size of life. The large rose-window, besides a variety of symbols, scrolls, sentences, and arms, intended to form a rich piece of mosaic work, conformable to the practice of the old glass painters, will contain thirty-two subjects illustrative of the life of Christ, wherein the height of the figures will be about three feet. The impulse which has lately been given to glass-painting in England is a pleasant sign, and cannot be too strongly aided. So firm was the belief that English artists in this department were inferior to foreigners, that the Chapter, it is said, had nearly determined on sending to Germany for the work in question; luckily, however, one or two members of it were staunch friends to English art, and succeeded in making the present arrangement; the result of which, it is to be hoped, will fully justify them for so doing.

We have not yet looked into the chapel of Henry VII, *orbis miraculum*, as Leland calls it—one of the most beautiful specimens of the last period of Gothic architecture which England or any other country can boast.[1] From its roof, "pendent by subtle magic," to the floor, the whole presents a rich lace-work of decoration. The lover of architecture, after studying the perfect development of the pointed style in the Minster itself,[2] with its acutely pointed arches, its lofty attenuated columns, its infinite divisions, finds here the style which succeeded it when the arch was becoming more horizontal, and when a love of decoration threatened, as indeed did soon afterwards happen, to overwhelm good taste, and lead to the abandonment for a time, of pointed architecture altogether.

With respect to sculpture, Henry VII's chapel presents one of the finest illustrations of early art, in England, in the series of figures which fill the countless recesses in the walls. It is said they were once three thousand in number, but this is perhaps doubtful. They display admirable feeling for art, and will well repay attentive examination. The carving too, in the stalls here, is good, and leads us to express regret that so little encouragement is now given to this branch of art in England. There are a considerable number of artists employed in it at this time, but unfortunately—such is the dominion of fashion, (another word for caprice,)—it is chiefly, if not wholly, in the imitation of old work, to be afterwards stained and sold as such. The upholsterer is the *arbiter elegantiarum*, and the result is, exactly what might be expected under such circumstances. The remedy for this, and many like evils, is, to make artistical knowledge more general, and to induce the multitudes to talk and think on the subject. With an increased public—an extended circle of admirers and employers—the powers of the artist will be more fully called into play, and the more critical that public is, the more strenuous will the efforts of the artist be to maintain himself superior to his judges.

George Godwin.

MESSRS. W. FAIRBAIRN & CO.'S IMPROVED PATENT RIVETING MACHINE.

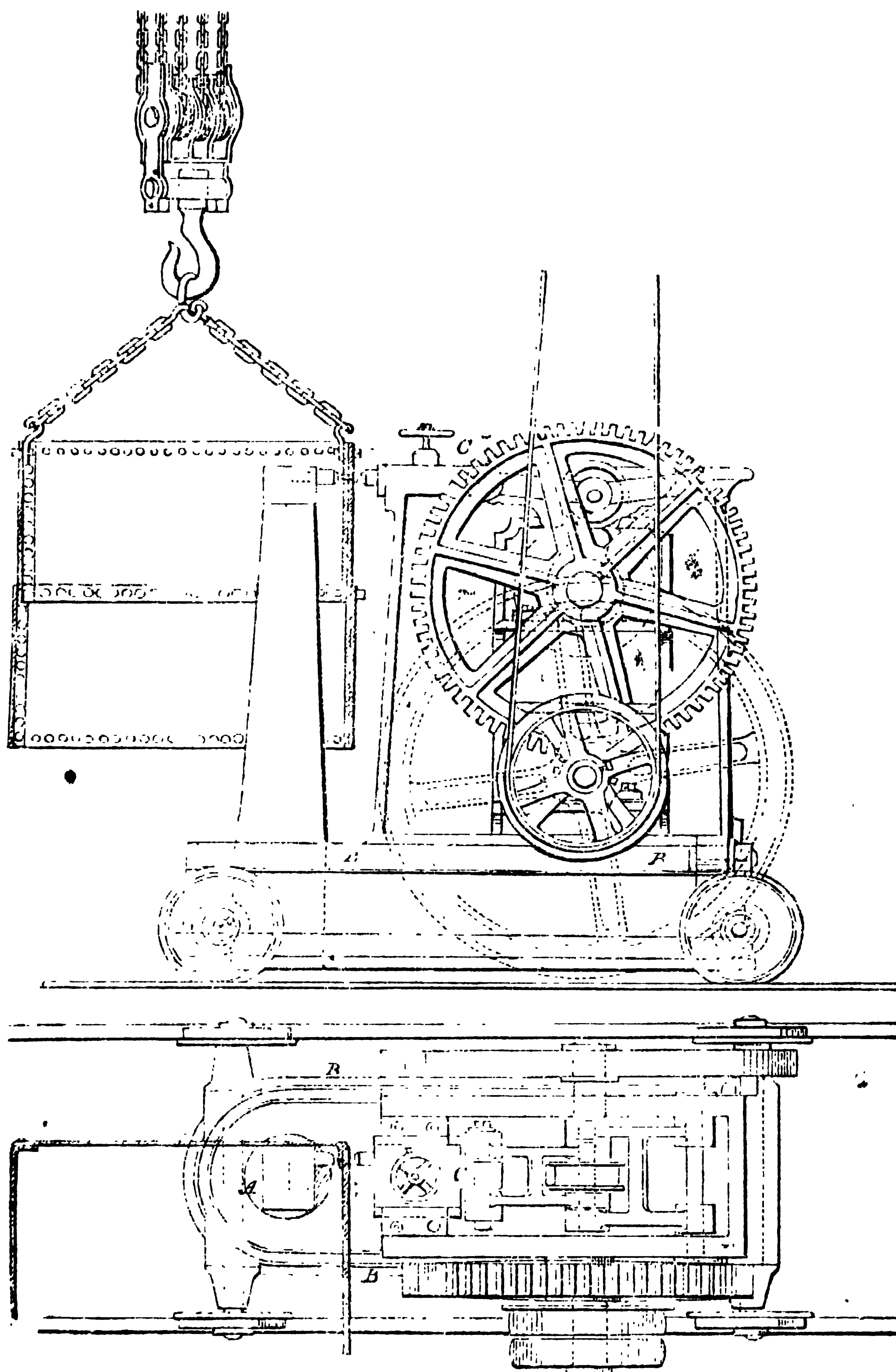
The annexed is a drawing of the Patent Riveting Machine as now constructed by Mr. Fairbairn, of Manchester, drawn to a scale of half an inch to the foot. It is widely different in construction from the machine first made, embodying many improvements, and remedying several defects to which the former was subject.

The machine is worked in the following manner; a strap or band leading from the shafting of a steam engine passes round a pulley, and causes the same to revolve, and with it a pinion fixed upon its axis working into the large spur wheel; upon the axis of the latter is a cam which acts upon the knee joint of the jointed bars at the top, and forces forward the moving slide C, and with it the die against the head of the rivet, and the inner point of the rivet against a corresponding die fixed upon the top of the stem A, the rivet being previously heated in the usual manner.

The large stem A is now made of malleable iron, and having an iron strap B B screwed round the base, it renders the whole perfectly safe in the case of the dies coming in contact with a cold rivet, or any other hard substance, during the process. Its construction also allows the workmen to rivet angle iron along the edges, and to finish the corners of boilers, tanks, and cisterns; and the stem being now made four feet six inches high, it renders the machine more extensive in its application, and allows of its riveting the fire-box of a locomotive boiler, or any other work, within the given depth. In addition to these advantages, it has a broad moving slide C, in which are three dies corresponding with others on the top of the wrought-iron stem. By using the centre die, every description of flat and circular work can be riveted, and by selecting those on the sides it will rivet the corners, and thus complete vessels of almost every shape. Another advantage of this machine is its portable form, and the facility with

[1] Commenced 1503.
[2] Commenced A.D. 1220.

FAIRBAIRN'S RIVETING MACHINE.—Elevation and Plan.



which it can be moved on rails, to suit the article suspended from the shears. The introduction of the knee joint is also a very important improvement, as it gives to the dies a variable motion, and causes the greatest force to be exerted at the proper time, viz., at the closing of the joint and the finishing of the head of the rivet.

In other respects the Machine operates as before, effecting by an almost instantaneous pressure what is performed in the ordinary mode by a long series of impacts. The machine fixes in the firmest manner, and completes eight rivets of ¾-inch diameter in a minute, with the attendance of two men and two boys to the plates and rivets; whereas, the average work that can be done by two riveters, with one "holder on," and a boy, is forty ¾-inch rivets per hour; the quantity done in the two cases being in the proportion of 40 to 480, or as 1 to 12, exclusive of the saving of one man's labour.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XLVII.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. "The works of Messrs. Whewell and Willis, honorary members of the Royal Institute of British Architects, reflect the greatest credit upon their penetration and learning:"—so says Professor Donaldson, and therefore so far differs *toto cœlo* from the author of a certain "Encyclopædia," who, although he does not name those gentlemen, gives a pretty broad hint as to the esteem he entertains for them and their works; which last, he has considered unworthy of being named in the list he gives of architectural publications—a list, by the bye, that seems to have been made up from a bookseller's catalogue. However, the "Encyclopædia" has got plenty of puff from some of the country newspapers, therefore, it is to be hoped that Mr. Gwilt will now become quite reconciled to "small-fry critics," of that class, who, if they do not understand anything of the subject, are most conveniently blind to defects and blunders, yet at the same time so lynx-eyed, that they discover wonderful learning and industry, where others detect great carelessness, and the mere handicraft of scissors and paste. As to Mr. Donaldson, his "learned and scientific professional brother," as he styles him, is not likely to be at all pleased at his complimenting the two W's.

II. Donaldson is certainly the most good-natured of critics—liberal of praise even to a fault, for he bestows it so freely as to render it quite common, and hardly worth having; in which respect, however, he does not exactly stand alone, yet one looks for something superior to ordinary puff, from a professional man and a Professor. After that honey, a gentle squeeze of acid from Welby Pugin will prove refreshing; and no doubt he will give us some of it by and bye, in his forthcoming work. His bill of fare promises some relish of the kind; and there are one or two capital tid-bits for him to serve up to us, should he not have overlooked them. It is a pity that he does not mean to give us a chapter on "Lost Opportunities," but a chapter would hardly suffice to enumerate them all—they would require a volume. As to his idea of recommending Gothic architecture, as our general style at the present day, and for public buildings of all kinds, it seems to be somewhat a visionary and Quixotic one. At any rate he will hardly be able to enforce his argument by satisfactory and encouraging examples, proving how successfully we can now accommodate that style to every purpose and every occasion. But what does Pugin himself mean by clapping that odd bristling *chevaux-de-frise* on the ridge of St. George's Catholic church? It looks neither useful nor ornamental—quite the contrary: nor does there seem to be precedent for it, much as it stands in need of authority to reconcile us at all to it.

III. If instead of falling foul on reviewers, anonymous critics, and others of that class, and bestowing upon them a good deal of his "Big bow-wow," as Scott calls it, the illustrious Joseph had condescended to point out some of the best architectural papers that are to be found scattered up and down periodicals, foreign as well as English ones, he would have performed a good office. There are several of the kind in the *Quarterly Review*, although of late that journal has given us nothing on the subject of architecture; and from that entitled the "Modern Palladian Architecture of Italy," he himself might have picked up some information which he does not appear to possess. No doubt there has been a good deal of flimsy nonsense written in periodicals, not only upon architecture, but other subjects also: yet it does not therefore follow that there is nothing at all good, or deserving attention, to be met with in the shape of magazine and review articles; and as the good ones, it seems, bear so small a proportion to the rest, a list of them would not have occupied a great deal of room—though as for the matter of room, Gwilt had more than he knew how to fill up, except by cramming into his book such heterogeneous stuff as tables of compound interest. Taken in general, reviewers—more especially architectural reviewers, may be the ignoramusses Gwilt represents them. Nevertheless, every rule has its exceptions: at any rate, certain it is that some who have written in periodicals are not only professional men, but those who as such stand rather high in public opinion. Professor Pugin, for instance, has written in the *Dublin Review*; and each of the other Professors—Cockerell, Hosking and Donaldson, stands suspected of having occasionally contributed to periodical publications. How they relish Gwilt's remarks may, therefore, easily be conceived. Whether the venerable Vitruvius and the great Palladio were ever guilty of any thing so unprofessional and so horrible, may be questioned, because in their times—oh! happy times for architecture!—there were no periodicals; and if there had been, those great luminaries of art, would not have put their light under a bushel. Surely an "ignorant reviewer" may be excused from admiring Schinkel, when for so doing he had the authority of all Germany. To vent his wroth on such a poor devil, looks like cowardice on the part of Mr. Gwilt, more especially as he might attack architectural heresy in "high places," and display his prowess against giants instead of dwarfs. Besides,

Thyself, friend Joseph, may at times be wrong;
Bethink thee, then, what says the song,
"Remember, where the judgment's weak,
The prejudice is strong."
And there, 'twould seem thy strength most lies.
Reviewers, why should you so rail at and despise?
On them why all thy vengeance wreak—
Reviewers, meekest of the meek,
If not the wisest of the wise?

IV. There is no department of biography in which less has been done than that of architects; and, strange to say, least of all has been done—at any rate in this country—of late years, when even the most eminent—if not exactly the ablest—in the profession have obtained only a mere passing notice in an obituary—hardly so full a one as is bestowed upon some of those "distinguished," persons of whom the world never heard while living, nor will care to remember when dead. Wyatt, Gandon, Soane, Wyatville, Wilkins, and Rickman, have passed away without obtaining more than that kind of notice. In Soane's case, indeed, it was entirely his own fault, for a handsome legacy would have secured him a splendid biographical monument from one who was always telling the world of his esteem for Sir John, but who has since written him plain "Soane," without the knightly prefix, and without *endearing* compliment of any kind. Well, perhaps poor Soane had no relish for "extreme unction," administered by an Egyptian—that is, by a crocodile.

V. "It is found easier," says a writer in the *Edinburgh Review*, "to deal with generalities and abstraction, than to descend to particulars; to frame a theory, or a philosophical essay having the slenderest application to the case in hand, than to direct the criticism to the real appreciation of the work to be reviewed." This is more especially true as regards architectural criticism, or what is given to the world as such: of general remark that has been worn threadbare, there is usually an overdose, while the building which calls it forth, obtains no further notice than two or three lines, and sometimes not even so much. When such is the case, we may without any very great breach of charity, suppose that the writers know not how to apply their own principles—supposing them to be really their own, which is doubtful, and to test by them what they profess to examine and pass sentence upon. Indeed, it occasionally happens that the opinion they express, is altogether at variance with the principles they pretend to lay down:—after twaddling about Grecian architecture, for instance, they will praise what is no better than an abominable caricature or preposterous application of it—at the best a servile copy in regard to mere columns, and those generally introduced so injudiciously as to render all the rest more insignificant in character than it otherwise might have appeared.

VI. Innovation is the bugbear of architects, and is most solemnly of all, deprecated by those who themselves do not possess a fresh

idea to start from. Yet what does the history of architecture—or, indeed, of all art, present, but a series and continued course of innovation? How should we have got Gothic at all, without innovation; or having been introduced, how could it have advanced beyond its first stages? Architecture does not indeed admit of fashions, if by fashions are meant fresh patterns every month for dandies of both sexes. But change, growth, and further development, there may and must be; for the very principle of art prevents architecture from continuing stationary. If it cannot advance, it must retrograde, and become entirely mechanical, without aught worthy the name of design. It is owing to our not striving to get forward at all, but confining ourselves to repetitions of the same forms and ideas over and over again, that we at length suddenly abandon them altogether, satiated with the unvarying sameness of a style we have stereotyped, and despairing of obtaining variety, except by going to one entirely different. Thus Elizabethan is taken up by way of change from Grecian, because no one knows how to produce any novelty in Grecian itself.

VII. An architectural book, I am informed, has just appeared, edited by Lady Mary Fox: but "*edited*" has of late become such an equivocal term, that its meaning in this instance is exceedingly doubtful. No one ever heard before that Lady Mary had made architecture her study; and even were she ever so well qualified for the task, it is strange that, merely for the sake of seeing her name so introduced upon a title-page, a lady should condescend to accept the job of superintending the printing of a book. Lady Mary, however, it seems, is not above even crying "stinking fish!" for it is said in the preface that the work, which it seems is partly from the German, is incorrectly translated! If such be the case, it was then surely the duty of her editorial ladyship to revise and correct those portions instead of knowingly sending forth to the public what she was aware was very inadequately executed. At any rate there was no occasion to tell the world how utterly unable she was to get through the *job* she had undertaken, and to confess her own incompetence with a degree of ingenuousness that amounts to stupidity.

OBSERVATIONS ON RIPON CATHEDRAL

Read at the Royal Institute of British Architects. By Mr. Morris.

[illegible]

P[illegible]

In the seventh century an animated controversy divided the polemics of the Anglo-Saxon church concerning the time of celebrating Easter. The Northumbrians observing the Irish tradition, kept the festival upon the Sunday that fell between the 14th and 20th days of the Paschal moon, while in most parts of the country the Roman practice was followed. Thus Bede tells us that two Easters were sometimes observed in one year, and the Northumbrian king and his queen being divided in opinion, it would happen that when the king having completed his Lenten fast was celebrating Easter, the queen still fasting was spending Palm Sunday.

Wilfred, an ecclesiastic, had at the age of 20 been sent to Rome under the auspices of queen Edleda, for the purpose of acquiring at the papal see, the best information on the subject of dispute, and on his return is said to have taken a distinguished part at the Synod of Whitby, held in 664; and his success was followed by his appointment to the Episcopal Chair of York, from which he was afterwards twice ejected, on the last occasion being absent for 10 years, and it would seem that he visited Rome in both intervals, and found [illegible] if not a powerful ally in the pope.

In the year 661 Alchfrid, king of Deira, bestowed upon Eata Abbot of Melrose and Lindisfarne certain lands at Ripon, where, allured by the beauty of its situation he built a monastery. But soon after its erection the monks, (among whom was St. Cuthbert,) on account of their unconformance to the Catholic observance of Easter, were expelled the monastery by Alchfrid, who then conferred it, endowed with 30 hides of land, upon Wilfred, who, notwithstanding his subsequent elevation, retained it during his life. King Athelstan gave it the privilege of sanctuary, which extended a mile round the church, so that not only the church but the whole town was a place of refuge to all who fled to it. One (if not more) of the crosses marking the bounds of sanctuary yet remains.

It would have been strange, indeed, had a prelate, endowed with Wilfred's mental and physical energy, made repeated and protracted sojourns in the "Eternal city," without acquiring some regard for its architectural treasures and a desire to emulate them on his native soil. That he was thus affected, we have the most satisfactory evidence; and ecclesiastical architecture in this country was more indebted to him than to any other person of that age. Notices of his works are found in his biographer Heddius, Richard of Hexham, William of Malmesbury, and other ancient writers, of which a summary sufficient for our present purpose will be found in Britton's York Cathedral and the Chronological Volume. From these we learn that he erected in Ripon a church of hewn stone supported with various columns and porticos, and completed it from its foundation to the summit.

"The church of St. Andrew at Hexham he built, laying the foundations deep in the earth with great care, forming crypts and subterranean oratories, and winding passages. The walls, extending to a great length, and raised to a great height, were divided into three distinct stories, supported by polished columns, some square, and others of various forms. The walls and likewise the capitals of the columns by which they were supported, and the arch of the sanctuary, were decorated with histories and images and different figures, carved in relief on stone, and painted with colours, displaying a pleasing variety and wonderful beauty. The body of the church was likewise surrounded on all sides by *portices* and porticos, which, with the most wonderful artifice, were divided above and below by walls and winding stairs. Within these winding passages and over them were stairs and galleries of stone, and various methods for ascending and descending, so ingeniously contrived, that a vast multitude of persons might be there and pass round the church without being visible to any one in the nave below. Many oratories also, most retired and beautiful, were, with the utmost care and diligence, erected in the porticos both above and below, and in them were placed *altars* in honour of *the blessed mother of God*, the Virgin Mary, St. Michael the Archangel, St. John the Baptist, and the Holy Apostles, martyrs, confessors, and virgins, with all becoming and proper furniture belonging to them."

I have transcribed this passage relative to the church at Hexham, as its circumstantial character can hardly fail to be interesting; and it illustrates in a very decided manner the highly artificial models copied by the architect. Indeed, I question whether old St. Paul's, Salisbury, Westminster or Durham, in the very zenith of their magnificence, could have furnished more glowing images to the pictoral imagination of the good old chronicler, Richard the Prior, who wrote towards the end of the 12th century, when the church after 500 years, though bowed and stricken with age, retained like a patriarch, the indelible traces of former glory.

Wilfred is said to have erected two other churches at Hexham, besides several in other parts of England; and Bentham supposes that he superintended the erection of the church and monastery of Ely. Indeed, he appears to have been equally celebrated for his theological and architectural acquirements, being eminent for his knowledge and skill in the science of architecture, and was himself the principal director of all those works in concert with the excellent masters whom the hopes of preferment had invited from Rome and other places, to execute the plans which he had formed.

William of Malmesbury also notices the beauty of the pavements; and there is little doubt that where so much emulation existed, an attempt to imitate the mosaics of Rome would be made. In the small, half ruinated, hospital chapel of St. Mary Magdalen at Ripon, is a venerable relic of some such effort, with tesseræ about half an inch square; and on the site of the high altar at Fountains' Abbey, a pavement remains which has glazed tiles of various forms and colours to suit the geometrical figures of the design, which exhibits great elegance and variety; and I think this kind of paving may be considered to have intervened between the former and the inlaid or encaustic tiles met with at Romsey, Salisbury, Winchester, and many other places, an attempt to revive which method has lately been made with some success, and from the present state of the manufactures in pottery, the most beautiful productions may be expected. At Winchester are to be seen some examples of embossed tiles, or with the ornaments raised from the surface or ground.

In Bishop Wilfred's time then we find the church and monastery settled on a permanent footing—his labours and benefactions endeared him to the inhabitants, and the demonstration of rapturous and enthusiastic affection which marked his return from exile, is still commemorated by the annual observance of a mimic pageant. The church,

however, that he raised with so much care, and so cunningly adorned, and the monastery whose walls so often reverberated the applause of his virtues, are now no more seen, and the finger of tradition alone, points out the spot where once they stood.

The present cathedral occupies a more elevated and commanding site to the westward. It was commenced by Archbishop Thurston, soon after his advancement to the see of York, (in 1119). The plan was a simple cross, and the style Anglo-Norman with semi-circular and pointed arches promiscuously applied. The walls, as usual in similar buildings, are thick enough to allow galleries or passages to be formed in them. The doors are ornamented with shafts and arch mouldings, in which richness is produced by the repetition of a simple elementary form; and it is worthy of notice, that in the Norman arches the blocks of stone, though moulded or carved in a variety of ways, never wholly lost the original square figure, previously given to them. Without asserting, therefore, that at this period the mouldings and ornaments were actually wrought after the stonework *was set*, such a disposition of the mouldings would tend very much to simplify that process: and it will further be found that these ornaments are not unfrequently modified to suit the actual size of the blocks. There is a low central tower with good detail; and immediately under this is a small crypt or cell, with access from the nave, and also from the choir. To what use it was appropriated does not seem very clearly decided, its extreme dreariness suggesting the idea of a penitentiary; and the small recesses in the sides suitable for the reception of a lamp or crucifix assisting the notion. It may have served simply as a confessional; but whether intended for the momentary reception, or more *perdurable* home of the sinner, or the fugitive from the arms of the temporal power, it is evident that the priest entering from the choir could communicate with and not be seen by a person brought down from the nave. For this purpose there was an orifice in the wall that has acquired the name of St. Wilfred's needle, which the more energetic visitors make a point of endeavouring to get through: and the fine polish acquired by the stone in its contact with silk and broadcloth, show that the attempt is pretty generally made with success. Since the completion of the original structure, no building has perhaps undergone such important alterations without a more complete destruction of its individuality.

The transepts, however, bear more legibly than any other portions, the impress of the 12th century, but the inner roofs appear never to have been completed. Small shafts suited to support the foot of a groin (revealing a purpose unfulfilled) are carried up (here as in many other instances) story after story, and are at last left without adaptation either to a flat or vaulted ceiling; and thus from the absence of an homogeneous and appropriate inner roof half the effect is lost. How lame and abrupt does the flat ceiling at Peterborough appear to an eye that has dwelt on the masculine vaulting of Durham! The cause of the very few instances of Norman groining remaining, except in crypts, and the fair presumption that not many ever existed, is a subject open to investigation, and a speculative idea may be not without its utility in eliciting satisfactory information. Thick as the walls of that period are known to be, the risk that would have attended charging them with stone ceilings, without the auxiliary resistance of external buttresses, may have become an object of anxiety with the builders, and the execution of such works in stone may have been attended with difficulties which even at this time would be considerable, and may then have proved altogether insurmountable, except under the most favourable circumstances, and amplitude of means. The centering alone, if considered for a moment, is an object involving so considerable an amount of expense and practical skill, that we cannot wonder that even in the best days of the art, methods should have been devised for dispensing with it, and hence doubtlessly arose the adoption of wood at Lincoln, York, and elsewhere. Did not the Norman builders feel and shrink from the difficulty like their successors, but without the good fortune to hit upon so happy an expedient? We know that they affected the groin, from its constant adoption in crypts and ailes, when a moderate span facilitated its execution. As the central tower presented the strongest abutments for an arch of any part of the church, it is possible that a groin existed there similar to that at Lindisfarn, in Northumberland, and causes for its non-existence, at the present time, are by no means deficent. Before leaving the transept we may notice that on the east side of each, there is a chapel of two arches; that in the north transept being nearly coeval with the church, and that in the south, of the fourteenth or fifteenth century.

The choir comprised originally three arches only, but was subsequently increased to six. The effect is curious at first, from the circumstance of the triforium arches being filled with tracery and glazed, and the roofs having been lowered. It looks, therefore, like a double clerestory. The addition of the arches appears to have been carefully made to assimilate with the original work, but subsequent alterations bear the characteristic of their own date. In 1319, the church was burnt and greatly injured by the Scots, but restored by the munificence of Edward III, Melton, archbishop of York, and others; and the "steeples" were then added, of which the central one, 40 yards high, was called St. Wilfred's.

There is an old print which shows spires on the central and western towers similar to Litchfield. The former was blown down in 1660, destroying in its fall a part of the south side, of which the reinstatement (said to have been done at the expense of one of the prebendaries) is still perceptible, by the variation in style. After this accident the other spires were removed. In the south aile is a large piscina, probably used for washing the sacerdotal linen, and round the the sides and end there was arched-headed panelling, but part of this is now displaced by the altar screen, erected some few years ago from a design by Mr. Blore, under whom also the groined ceiling was restored, in which are preserved the ancient wooden bosses, which are very beautiful. The east window, erroneously said by Rickman to be of five only, consists of seven lights, and is a fine example of the kind. The clear opening is 48 feet high. Sir William de Plumpton was founder of a chantry at the altar of the Holy Trinity behind the high altar. The act of endowment is dated at Ripon on Wednesday, the feast of the conversion of St. Paul, 20 Edward III, 1345, and was sealed with the seals of Henry de Plumpton, the chaplain first appointed thereto, and of Sir William de Plumpton, which bore the impression of a shield, and on it five fusils, with the name written on the circumference. This chantry was screened from the rest of the church, and under lock and key, but no vestige of it remains.

Near the altar on the south side of the choir are three sedilia and a piscina of curious and elaborate design and skilful execution. The arches are cinquefoiled, the cusps being ornamented with small grotesque heads or other figures, which at the first glance appear to terminate the design; but, on closer inspection, it is found that the small bas-relief first seen is merely the crown of another head in high relief, of a figure falling into bas-relief and covering the soffit of the arch. These figures have human heads with the bodies of quadrupeds. They are of either sex and habited in full monastic costume; and the stout friar is regarding, with an expression too energetic to be perfectly platonic, the beautiful coy, and wimpled [1] nun. Seats of this kind are not of unfrequent occurrence in English cathedral and other churches, as well as in those of the continent: "at Sens, on the epistle or south side of the high altar are five seats. One for the celebrant, (which is highest,) two for deacons, and as many for subdeacons, all officiating while the other priests were in the choir." "*One single seat*," continues the essayist, (*Clark in the Archæologia*,) "is accounted for by the *choir* performing the part of *sub-deacon*, and one priest that of celebrant and deacon. In churches better endowed, beside the celebrant one performed the part of deacon and subdeacon. In such churches were *two seats*. Thus the number was proportionate to the richness of the endowment, and the seats intended for the officiating clergy only. The bishops' seats, were at the east and by the side of the altar. The choir is rich in carved oakwork. The stalls are furnished with misereres and tabernacle work, (which is said to have formed the model for the new work in the choir of York Minster.) The throne is also an object of interest, as presenting one of the earliest evidences of the architectural attainments of the noble Earl, the President of the Institute of British Architects.

The organ screen is of bold and original character, without pretending to the extreme elaboration of that at York. Adjacent to this stands part of a rich stone pulpit. The central tower has for some generations, presented a most singular and heterogeneous spectacle, but at the same time affording to the professional observer a valuable comparative view of the varied proportion and effect of the first and latest eras of true Gothic. In point of expansive lightness, the earlier style is certainly entitled to our admiration, though mass and richness may be exclusively the merit of the latter. Three of the piers of the central tower were cased in the perpendicular period, and the arches of the choir and south transept were also completed; but the fourth pier and the arches of the nave and north transept retain their original form. It is also illustrative of the method pursued to find the perpendicular work carried on the two sides quite up to the battlements. The immense size of the piers and the increased height of the springing, has the effect of contracting the opening of the arch, and also of rendering it necessary to ramp up the longitudinal crown rib of the groin.

Taking our survey in chronological order, the next point for consideration is the west front, which comprises the end wall of the

[1] The wimple is a [illegible] of the head dress.

nave and the two flanking towers, each of which is about 28 feet wide and 112 high. The present termination is not original, the battlements and pinnacles being of much later date. As to the mode in which they were originally finished it may be difficult to furnish a satisfactory suggestion; but of that which remains it would be still more difficult to convey an adequate impression. The simplicity of its outline, the unbroken massiveness of its general feature, and the rich and effective detail, respectively contribute to the grandeur of an ensemble unsurpassed by any building of its date.

The lower story has three doors into the church, and the second five successive windows extending the whole width of the nave, with a passage in the thickness of the wall. The second stage has an equal number of windows, the heads of which are elevated towards the centre to compose more readily with the gable, which is filled up by a triple window and trefoil panel. The windows are of two lights with trefoil heads and a trefoil in a circle above. Between the windows are piers of several shafts with foliated capitals, and the pierced pyramid or four-leaved rose; and the wall is very thick here to receive the many shafts and deep receding mouldings with which they are charged. The buttresses of the towers are broad and flat, with shafts in square recesses at the quoins, and run the entire height without diminution: the windows (except that some are filled with louvres) corresponding nearly in form and date with those of the central front. It is an interesting circumstance that the progress of almost every change in this edifice can be traced at this moment with no other guide than a little reflection, and with nearly as much clearness as the most circumstantial chronicle could have recounted them. The Norman nave, for instance, is shown to have extended as far westward as the present, from the fact that the builders in making their addition, left as much of the old work remaining as could be rendered available; and a portion of the old nave has thus been preserved, and the perfect coincidence of the joints of the piers with those of the west wall, show that the formation of the fine arches into the towers from the nave was predetermined in the design of the architect, and not an afterthought as might on a cursory view be imagined; indeed, it may be noticed that the interiors of these towers were finished with great care, and were intended to be entirely open to view from the floor to the roof, where the walls are terminated by a cornice and corbel-table. The moulded piers and arches of the lower stories are very fine, and become plainer in proportion to their remoteness from the eye. At each story was a gallery of communication, not only round the interior of each tower, but across the front from one tower to another.

I should have noticed that while the pyramidal flower is abundantly used in the vertical lines and in the arches, the flattened uncut pyramid, usually called the nail head, is adopted with equal constancy in the horizontal bands and dripstones; yet there is not the slightest taint of monotony discernible throughout. Beautiful as the principle of construction here observed must be generally deemed, giving an appearance of the utmost solidity and strength, with a comparatively small amont of material, it is to be regretted that there was a practical disregard of *bond*, and from the very inconsiderable proportion of horizontal masonry the towers were divided by the windows into four insulated vertical piers, with no adequate tie to meet the contingency of a tendency to spread at the top. The subtle workings of half a dozen centuries, however, manifest the necessity for a precaution that was not contemplated by the builder.

It is, I think, pretty evident that the primary plan was a simple Latin cross, without ailes. The transepts retain their original form, except that chapels have been erected in the east walls, and arches have been opened into the ailes of the nave; while the continuation of the base mouldings, and other external decorations of the towers, attest the absence of ailes at the time of their construction. The present nave may be referred to the close of the 11th century, and is a fine masculine example of that date. It has no *triforium*, but the clerestory windows are large, and have a gallery running through the piers. The wall ribs which exist indicate the purpose and form of groined inner roofs; but it is to be regretted that this part of the design has never been effected; and the external pinnacles were also left in an unfinished state.

Although the interior of this church cannot boast much of the rich garniture of ancient monuments or mortuary reliques, its impressive and venerable aspect cannot fail to call forth our admiration and respect; and the circumstance of its comprising fine decisive portions of the consecutive styles including Norman and perpendicular, render it an object deserving the careful attention of the architectural student and antiquary.

It only remains to notice a small building on the south of the choir, a lower apartment of which has obtained some celebrity in modern times as the bone-house, from the immense number and symmetrical disposition of the exuviæ of innumerable tenants of yet more circumscribed and darksome chambers, from which they were ejected some half century ago. They are now built in masses like masonry, and exhibit an affecting display, to speak in the language of heraldry of *morts* and *saltires* argent. (There was a similar instance at Sligo and another at Hythe.) This charnel house has certainly the characteristics of extreme age, and the formation of the vaulting accords with the earlier imitations of classic examples. The apsis at the east, and certain external details also, attest its ancient foundation. Immediately above is an apartment now used as the *vestry*, but formerly the chapel, to which the part just considered formed the crypt. It is entered from the aile of the choir, and is of a very simple character; vaulted, and retains its ancient piscina. This building has been deemed anterior to the body of the Minster; but when we consider the casualties to which, from its position, it would have been subject during the erection of so large a pile immediately contiguous, it will probably be more rational to assign it a contemporary date. May it not have been the lady chapel, or chancel chapel? of which there is a fine example now used as a school at the west end of Norwich Cathedral, with a crypt below; and it may be borne in mind that both Norwich and Ripon are Norman foundations without crypts.

THE EXPLOSIVE FORCE OF GUNPOWDER.

The recent successful destruction of the Round Down Cliff, at Dover, by gunpowder, of which a full description was given in the February number of our *Journal*, suggests a consideration of the explosive force of that agent, and of the best means of applying its power.

The circumstance which excited most surprise in the blast at Dover, was the absence of all indication of explosive effort. That the cliff should have been rent asunder by the force of the immense quantity of gunpowder employed, was to have been expected; but that the effect should have been produced so gradually, without any report or flame, or other usual accompaniment of an explosion of that agent, appeared contrary to the ordinary conception of blasting operations, and induced the operating engineers to imagine, at first, that the charge had missed fire. The result has shown that Mr. Cubitt adjusted with great exactness, the amount of power to the resistance to be overcome; and it has shown, practically, that the explosive force of gunpowder, in any quantity, may be controlled, and brought to act with a steady effort, like any other moving power. Had the quantity of powder been much greater than it was, or had the same quantity been placed nearer to the face of the cliff, there can be little doubt the blast would have been accompanied by all the usual phenomena of explosion. Had the quantity of powder been less, probably even to a small degree, its force would have been either pent up within the rock, without producing any effect, or it would have found vent by blowing out the tamping.

The force of ignited gunpowder, it is generally admitted, arises from the sudden generation of a quantity of a permanently elastic gaseous fluid, and the expansion of that fluid by the heat excited during the ignition of the powder. The volume of elastic gas generated by the explosion of gunpowder, after it is cooled down to the temperature of the atmosphere, has been determined by experiment to be 244 times greater than the bulk of the powder exploded. It is calculated that the heat produced by the ignition of the powder expands the generated gas into 1000 volumes at the moment of explosion; and that, consequently, fired gunpowder exerts a pressure equal to 1000 atmospheres, or about 6½ tons on the square inch.

The 18,000 lb. of gunpowder used in the blast at the Round Down Cliff would occupy about 300 cubic feet, and the capacity of the three chambers made to contain it was about 750 cubic feet. What space was left between the tamping and the powder chambers, we are not aware; but it would appear, from the published reports of the operation, that the tamping was rammed not far from the powder. We will assume, therefore, the total space within which the gunpowder was confined, to have been 900 cubic feet. This space would be three times the estimated bulk of the powder, exclusive of the containing

barrels and bags, therefore its first impulsive effort on being ignited would be $1000 \div 3 = 333\frac{1}{3}$ atmospheres, or about 5000 lb. the square inch; and the force of the permanent generated elastic fluid, when cooled, would be $244 \div 3 = 81\frac{1}{3}$ atmospheres, or about 1200 lb. to the square inch. Now, if we suppose the space within which the gunpowder was confined to have been cubical, each of the six sides would have exposed an internal surface to the action of the gunpowder of 100 square feet, equal to 14,400 square inches. As the pressure, according to the preceding calculation, would in the first instant be equal to 5000 lb. the square inch, the impulsive effort on each side of the cubical chamber would be 72,000,000 lb. or 32,143 tons. As the point of least resistance must necessarily have been towards the face of the cliff, the acting power may be considered as having been exerted only in that direction; therefore the cliff would be forced outwards with an impulse upwards of 32,000 tons. As the rock yielded to this immense power, the pent-up air would expand, and its force would consequently be diminished. The cooling of the generated gas would also greatly weaken its expansive force, and its gradual escape through the fissures of the falling rock would prevent any sudden explosion.

The sound which was heard was that of the rending of the solid rock, and not the firing of the powder; for it is well known that the explosive report of any detonating body is caused by the concussion of the air. This fact is proved by the firing of explosive mixtures of hydrogen and oxygen gases in a strong glass apparatus, for the purpose of obtaining the product of the combustion of the two gases. The apparatus usually employed contains about half a pint, the explosion of which quantity of the mixed gases, when in contact with the atmosphere, is sufficient to produce a report as loud as the firing of a pistol; but when the gases are fixed in a closed vessel, no report whatever is heard. This experiment proves also, on a small scale, the possibility of controlling explosive forces. The expansion of an explosive mixture of hydrogen and oxygen gases at the moment of combustion, amounts to 15 times its original volume, which gives a pressure of 15 atmospheres, or about 225 lb. to the square inch; yet the glass bottle in which the gases are fired is sufficient to control the explosive effort, and to prevent even any sound from being heard.

The quantity of gunpowder requisite in ordinary blasting operations must depend altogether on the hardness of the rock, and the mass intended to be moved. The proper adjustment of the quantity of powder to the resistance to be overcome, forms, however, an important consideration, for an excess of powder is not only a wasteful expenditure of a valuable agent, but it renders the operation more dangerous by the dispersion of fragments in all directions, and it not unfrequently diminishes the effect of a blast by concentrating the direction of the impulsive force. This is particularly the case in warlike operations, where the object in springing a mine is to make the destructive effects extend as far as possible. The aperture produced by the explosion, when a mine is properly charged, is a cone, the diameter of the base of which is double the height, taken from the centre of the mine. This calculation is founded on the supposition that the materials to be removed are either earth or soft clayey soil. The allowance of powder recommended for such mines is about 10 lb. per cubic fathom when the materials are loose earth, and for strong clayey soil about 16 lb. It is found that when the charge of powder greatly exceeds those quantities, the materials immediately above the powder are alone blown up, that the aperture is nearly cylindrical instead of conical, and consequently the sphere of its influence is diminished.

The explosive effects of a charge of powder in blasting, depends also materially on the mode of tamping. This is a point which, until a comparatively late period, was altogether overlooked, and it is not even now so generally attended to as its importance deserves. The notion which formerly obtained was, that the impulsive effort of the powder was greatly increased by ramming it tight. In gunnery practice this is correct; for when the ball is rammed closely to the powder, it is propelled with greater force than when it is not. But the required effects in the operations of blasting are exactly the opposite of those in gunnery. The ball and wadding of the gun may be considered as the tamping of the mine. To blow out this tamping without bursting the gun, is the object in gunnery—to retain the tamping and to burst the chamber holding the gunpowder is the object in blasting. To attain these different ends, the methods adopted in the two cases ought of course to be different. The well known fact that when a ball is rammed only a short way down the barrel of a gun, it will burst before the ball is forced out, affords a very instructive lesson in the practice of blasting, and shows clearly that to produce the most effect in rending the rock, and to run the least risk of blowing out the tamping, ample space should be left between the tamping and the powder. It is true that by leaving such a space for the expansion of the generated elastic fluid, the intensity of its action is diminished, but the same amount of power is distributed over a larger surface; its action accordingly approaches more to that of an ordinary mechanical force, and the liability to split the rock into small fragments is thereby decreased.

One great advantage in mining operations, derived from the practice of leaving a space between the tamping and the powder, arises from its admitting the use of loose dry sand for tamping, instead of requiring the blast hole to be filled and rammed tight with hard substances. The labour, the trouble, and the danger of tamping by the common process, renders the substitution of dry sand a great advantage, as the risk of igniting the powder by striking a spark, is entirely removed: and we suspect that in those cases where it has been found to fail, and the tamping has blown out, that the cause of failure may be attributed to the neglect to leave a sufficient space between the tamping and the powder.

The manner in which the space between the powder and the tamping operates in preventing the latter from being blown out, has been explained in the following manner. The force of fired gunpowder may be considered as proceeding from a point, and radiating in all directions round it. This force must, therefore, participate in the nature of all central forces, and diminish in intensity as the square of the distance. When a ball is rammed close to the powder, it approaches near to the point whence the force emanates, and sustains consequently its full effect; but when the ball is placed farther from the point of radiation, the force acting on it may be diminished many times within the space of half an inch. Suppose, for example, that a musket ball which, when close to the powder, is within a quarter of an inch of the centre of radiating power, were placed a quarter of an inch from contact with the powder, the impulsive force it would receive would be diminished four times. If it were removed to a distance of one inch from the charge, the force acting on it would be diminished sixteen times. If, therefore, we view the first impulsive effort of fired gunpowder as a radiating force, we perceive at once the cause of its diminished action on the tamping of a mine, when a space is left between it and the charge, and whether the tamping materials be sand or hard fragments of rock, the vacant space must be equally advantageous. Should the resistance be too great to yield to the first explosive effort of the gunpowder, the direction of the action of the pent up elastic fluid would cease to be radiating. It would resemble the pressure of compressed fluids, and act uniformly in all directions. The tamping would then be acted on by a power equivalent to the compression of the generated gases, and in a direction tending most effectually to force it out. It is under such circumstances, we conceive, that the tamping, whether of sand or rock, is most frequently blown.

The mode of tamping with dry sand has been brought into notice more particularly within the last two years, in connexion with Mr. Martyn Roberts's plan of blasting by galvanism; but it was known and practised successfully, we believe, 30 years ago, at Lord Elgin's mines at Charlestown, in Scotland. It is to be regretted that an improvement, attended evidently with so many advantages, and which is calculated to prevent accidents in the dangerous occupation of blasting, should have made such slow progress that more than 30 years have elapsed since its introduction without its general adoption.

IMPROVEMENT OF GEODESICAL INSTRUMENTS.

As connected with the profession of a civil engineer, the principles and practice of surveying is an important branch of study; under this term, we do not confine our meaning to the delineation of a few fields, or of a long narrow slip of land, such as railway plans usually present, but to the survey of extensive tracts of country or of islands, usually denominated trigonometrical surveying, because that branch of mathematics known as plain and spherical trigonometry, forms the basis or principle upon which such surveys are carried on. This branch of surveying has hitherto been principally confined to the officers of the corps of royal engineers, by whom the trigonometrical survey of the united kingdoms has been for so many years conducted; but although too much unheeded by students in civil engineering, it forms a legitimate branch of their studies, otherwise they cannot be said to be eligible to occupy such important stations as surveyors-general of our colonial possessions, where such surveys are so much needed, nay almost indispensable. Connected with this subject, the knowledge of the use and adjustments of the higher class of geodesical instruments is necessary, such as theodolites of large dimensions, but more especially an instrument called the altitude and azimuth instrument, from its two-fold application to the measurement of vertical and horizontal or azimuthal angles, and its peculiar applicability to the purposes of so much of astronomy as is requisite in such class of surveying, or we may call it the instrumental link which connects astronomy with geodesy and geography; any improvements, therefore, in the construction of instruments thus connected with the profession we profess to advocate, come fully within the limits of our province, and therefore we are desirous of calling attention to the following extracts from a paper that has been read before the Royal Astronomical Society on January 13th last, entitled "On a new arrangement of a Vertical Collimator attached to the Altitude and Azimuth Instrument." By William Simms, Esq.

"The only essential respect in which the altitude and azimuth instrument now before the society [1] differs from similar instruments by which it has been preceded, is this. The azimuth or vertical axis is perforated and fitted with an achromatic object-glass having a diaphragm in its focus, so as to serve, in conjunction with the spirit-level upon the instrument, as a vertical collimator.

"At present the spider lines in the diaphragm of the collimator form an acute cross, subtending an angle of about 30°; but the preference of this arrangement over two parallel lines placed very nearly together, so as to present a narrow space for bisection, admits perhaps of question; my own habit being that of bisecting an angle by a line, leads me to give to it the preference, although I have found by experiment that very satisfactory results may be obtained by the other arrangement.

"In this state of things, if the telescope be directed vertically downwards, the image of the cross in the collimator will be seen upon the diaphragm of the telescope; and the adjustment, independently of verticality, which must be effected by the spirit levels attached to the instrument, consists in so rectifying the optical axes, that the centres, or intersecting points in the telescope and collimator, remain coincident during an azimuthal revolution.

"The mode of adjustment, described in order, may be as follows, admitting, however, of variation at the pleasure of the observer.

"1. It will be found convenient that the instrument be first generally levelled:—the azimuth axis by turning 180° in azimuth, and correcting by the feet screws of the tripod and the adjusting screws of the spirit levels; but, in all cases, if the error be not beyond the range of the scales, it is far better to leave these screws untouched, and to apply the correction by reference to the divisions upon the scales. The axis of the altitude circle must be rectified by the striding level, exactly in the same manner as in the transit instrument; all which, however, is too well understood to need a particular description, in this place.

"2. To adjust the line of collimation, bring the vernier marked A to 90° or 270° upon the azimuth circle, and, by means of the adjusting screws at the eye end of the telescope, make the middle vertical, or meridian line, bisect the angles of the collimator cross, turn 180° in azimuth, and correct half the error by the above-mentioned screws, and the remaining half by moving the object-glass of the collimator.

"3. To correct the nadir point, set the vernier A to 0° or 180° upon the azimuth circle, 90° distant from its former position, and make the middle horizontal line bisect the angles of the collimator cross; turn 180° in azimuth, and correct half the error by giving motion to the telescope by means of the tangent screw, and half by moving the object glass of the collimator. The micrometers should now be set to the zero points upon the altitude circle. By those, however, who prefer numerical corrections to mechanical adjustments, which, when extreme accuracy is aimed at, are always tedious and difficult to execute satisfactorily, the nadir point may be readily determined by reading the altitude micrometers with the circle in the reversed position. The indications of the spirit-level fixed to the micrometer bar must, of course, be carefully attended to in such a determination.

"I shall conclude this notice by observing that the new application of the collimator does not deprive it of any uses and conveniences which it has in any other form, while at the same time it possesses advantages peculiar to itself. Its property, in common with the vertical floating collimator, of enabling the observer to set the axis of the altitude circle perfectly horizontal, irrespective of the riding level, is one which the level collimator does not possess. In common with the others, however, it affords a ready means of verifying and correcting the essential adjustments of the instrument without reference to any external object. An object adapted for such purposes should be both distant and well defined, conditions which imply a clearness of atmosphere perhaps not generally met with in any climate, and much less in that of our own country; moreover the collimator is equally available by night and by day: the light of a small lamp or taper being sufficient to render the lines visible.

"But it has greatly the superiority, particularly in operations out of doors, over the vertical floating, and also over the level collimator, because the latter requires supports independent of, and equally steady with, that upon which the instrument itself is placed; things by no means easy of attainment under any circumstances, and to the scientific traveller often perfectly impracticable.

"Neither is it a small advantage to dispense altogether with an additional instrument, which, to say the least, lessens the number of the traveller's cases, and with them his cares also. An extra instrument may by accident be injured, or through forgetfulness left behind, or for want of time to set up, or a steady support when set up, prove useless when it is most needed. But, by the new arrangement, the collimator becomes part and parcel of the instrument itself, and is so completely protected from injury that an accident could hardly impair or destroy it without at the same time destroying the entire instrument. Its introduction, too, into the perforated axis adds so little to the original cost of an instrument, that it may make a final claim on the score of economy."

[1] An instrument with the collimator attached was exhibited in the meeting room of the Society.

THE VELOCITY OF WATER IN VERTICAL PIPES.

We have been favoured with another letter from our able correspondent T. F——x, in reference to our position that water flows down vertical pipes with only half the velocity due to the height when issuing from an orifice. Our correspondent is not convinced by our arguments, and he reiterates his former opinion supported by many illustrations, and by the grave authority of Belidor. The same fault, however, which we before complained of, pervades the whole of his present argument; he takes for granted the question in dispute, and assumes, as established data, the very points respecting which we are at variance. We will let him, however, speak for himself.

"Sir—I am sure that, if all your readers derived as much useful information and pleasing instruction, as I am bound to say I did, from your remarks in the last month's *Journal*, on the 'Velocity of water in vertical pipes,' conveyed in a style at once clear and copious, they must look forward anxiously for the fulfilment of the promise in the concluding passage, of returning at some future period to a subject deserving so much consideration and study. Before you do so, however, I am anxious to point out to you what I conceive to be an error in your reasoning, and, at the same time, uphold the assertions contained in my last letter on the subject.—1st. That the velocity of the column of water in a vertical pipe *maintained full*, is not *half* that due to the height, but that it is expressed by the same formula as for all other falling bodies.—2nd. That cohesion does not satisfactorily explain the continuous flow of water in a vertical pipe; in other words, that there would be a continuous flow in the pipe even if one particle did not cohere to that immediately above it.

"It may appear presumptuous in me to endeavour to reply to your remarks, and to maintain these positions after reading your able ar-

ticle on the subject; but an explanation of them so clear and so obvious has occurred to me; and even your own article contains such ample proof of the truth of my assertions on the main point at issue between us, namely, the velocity of water in a vertical pipe, that even at the risk of being charged with presumption, and under all the disadvantages of endeavouring to maintain a discussion with one superior to me in scientific acquirements, I am tempted to offer you a few more remarks.

"I think it will be well to treat first 'the velocity of the water in the pipe,' that being the chief point of difference, and also because, succeeding in proving this, I think it will appear as a necessary consequence, that the uniform flow of water in the pipe is quite independent of the cohesion existing between 'one particle and that immediately *above* it.'

"You state, and evidently quite correctly, that, supposing a vertical pipe 16 feet in length full of water to have the supporting base removed 'it would be emptied by the fall of water in one second, the final velocity of the water on issuing from the pipe, would be 32 feet per second, and the mean of the initial and final velocities would be 16 feet per second.' This is evidently quite correct. The whole column of water falls like a block of marble; the upper and lower parts are equally subject to the action of gravity, and every particle of water descending equal spaces in equal times, the whole column will fall at once, and this even without supposing that 'each particle coheres to the particle immediately above it,' and quite independently of cohesion, except, of course, what I may term, lateral cohesion, or that existing between the particles of the same horizontal section. The momentum of such a column is, therefore, 16 feet multiplied by the weight of the water; but you also state that, if the pipe had not been permitted to empty itself, but had been maintained constantly full, the velocity of the column of water would be 16 feet, and the momentum consequently the same as in the former case. Would not this conclusion be sufficient to convince you that there is an error in your reasoning?

"In the first case, the momentum, according to your reasoning, is the same as in the second, when the pipe is maintained constantly full. Surely this must be wrong. The mistake appears to me to arise from your not taking into account that, the pipe being supposed constantly full, the water *must enter as fast* as it issues, whether this entering velocity is imparted to the water by the height of the reservoir or other force. If the height of the reservoir or other force which supplies the pipe with water, is not sufficient to impart to the entering water a velocity equal to that due to the *whole* height of the pipe, then, I maintain that the height of the water in the pipe will diminish proportionally, so as to regulate the issuing velocity according to the supply. I shall endeavour to explain this. No doubt, still supposing the pipe to be constantly full, and, as before, to be 16 feet in length, in the *first* second, the mean velocity will be only 16 feet per second, but for the remainder of the time, the velocity will be 32 feet per second, as will be apparent by carefully considering the following explanation.

"Let us first examine the velocity of the water at different points of the pipe in the first case; when the pipe being supposed full, and the supporting base removed, the water is allowed to fall freely, according to the law of gravitation: that the velocity at any point varies as the square root of its distance from the top of the pipe. At one fourth of the height, the velocity of the water, therefore, will be 16 feet per second; and at a foot from the top the velocity will be four feet per second; therefore, to keep a pipe one foot long constantly full, the water must flow in at the rate of four feet per second; and to maintain one four feet long full, the water must enter at 16 feet per second: if the reservoir does not supply water at this velocity, the pipe will not be perfectly full; and by analogy and following the same train of reasoning, we deduce that the pipe being 16 feet in length, the velocity will be 32 feet per second, and the water must enter the pipe at that rate. Suppose, for instance, the area of the pipe to be one square foot, if the reservoir supplies 32 cubic feet of water per second, then the pipe of 16 feet in length will be maintained constantly full; if the reservoir can only supply 16 cubic feet, then the pipe 16 feet in length will be maintained full only to one fourth of its height or four feet from the bottom; or let us suppose a glass tube 16 feet in length to be maintained full by pouring water from a jug, and let some colouring liquid, of the same specific gravity as water, be placed at the top, it will be found that as the colouring liquid descends, the velocity of the water poured in must be gradually increased until the colouring liquid has reached the bottom of the tube, when the velocity will be found to be 32 feet per second; during this second, therefore, the mean velocity will be 16 feet, and during the remainder of the time the velocity of the water to maintain the tube *full* must be 32 feet per second. If you do not pour in the water at this velocity, you will find, as I before stated that the tube will not be maintained full, but that the surface of the water will fall until the height of the filled part corresponds with the velocity of the supply.

"I trust I have proved even to your satisfaction that my reasoning on this point is correct. I have shown, from your own admission, viz., 'that the final velocity of the issuing water from the pipe in the first class, would be 32 feet per second, and the mean between the final and initial velocities 16 feet per second;' that to maintain a pipe 16 feet in length constantly full, requires the water to enter at the velocity of 32 feet per second, and, *vice versâ*, if the pipe be maintained constantly full, that the issuing velocity will be 32 feet per second. The above law is true of any body in vacuo; it is true of shot *in vacuo*: it would be true of shillings, in pleno, falling through a tube without friction, and fitting accurately the sides of the tube, so as to prevent the air from entering at the sides; they would also form a *rope*, and fall uniformly according to the same law, although there is here no *cohesion* in force: it is true from the mere effects of gravitation: but in order to keep up a continuous stream, if I may use the expression, the successive shillings must be dropped from a height such as to impart to them the velocity which the column has already acquired. In this case there is no cohesion, which causes 'one shilling to draw the one immediately above it,' and, therefore, why adduce this property of water to explain a fact when it can be accounted for by gravitation alone which acts on all bodies?

"I have already occupied so much of your valuable space, that I must defer bringing forward many illustrations of the above truths for some future period, hoping that you in the mean time will remember your promise, and enlighten us on a subject at present involved in so much obscurity. Since writing the above, I have met an authority of such eminence and celebrity on subjects of this nature, to support my views, that I cannot forbear quoting him at full length. The authority I allude to is Belidor, in the edition of his 'Architecture Hydraulique,' published at Paris in the year 1737, at page 170, paragraph 429 and 430, it is stated, 'that when a vertical pipe, of which the opening is equal to the base, is allowed to empty itself, the surface of the water acquires in falling a velocity which increases as that of bodies subject to gravity, which fall freely.' This is as you stated. In the next paragraph, 430, he states, 'As it is always possible to render uniform a retarded or accelerated velocity, in taking half of the greatest velocity, this must be done when we wish *to compute the discharge (la dépense) of a pipe, such as the preceding, which one always maintained full*;' and in paragraph 431, always alluding to pipes, 'the velocities of water are in the ratio of the square roots of the heights;' and further on he states that the velocity of the *issuing water* in a pipe *constantly full*, is that due to the *whole* height and not *half*; and also 'we can then, when it is convenient, substitute for the velocity of the water of the column, the square root of the height of the pipe.' I must conclude by requesting any of your readers who are not satisfied with my arguments, to peruse that part of Belidor from which I have quoted the above passages.

"I have the honour to be, Sir,

"Your obedient servant,

"T. F——x."

P.S. "In addition to the extracts which I have already given you from Belidor, I beg to add the following, in order to show more clearly that I have his support to my statement that the velocity is that due to the whole height. Chap. 3, paragraph 438, 'We can then say that the discharge *(la dépense)* of a pipe or reservoir during the time necessary for a body to fall freely from the height of the surface of the water above the bottom, is equal to a column of water which has for its base the orifice, and for height a line equal to the space which a body can move over with an uniform velocity during the time of the fall with the acquired velocity.' Apply this to a pipe of 16 feet; the time is a second, the acquired velocity 32 feet per second, and not 16 feet, as stated in your remarks.* Nothing can be more to the point than the above extract. It is true that Belidor has not remarked that the velocity of the whole column, if maintained full, increases every second, although it would appear that he was aware of the fact, from his statement in paragraph 573, when in treating of the momentum of water issuing from an orifice, he states that a pipe can never be maintained full by a reservoir unless the pipe be of such small diameter, that the friction retards the water more than gravity accelerates it.

Placing out of consideration for the present, the minor point respecting the cohesion of fluid particles, we shall confine ourselves

* It was the *mean* velocity we stated to be 16 feet per second, and not the final velocity.

strictly to the main question—the velocity of the water—and we shall endeavour to answer our correspondent's objections *seriatim*.

The first objection is founded on the momentum of the issuing fluid. We scarcely know in what manner it is intended to show the fallacy of our arguments, by placing the subject in that light. Our correspondent admits that the mean velocity of a column of water falling through a vertical pipe 16 feet long would be 16 feet per second, and surely if, as we contend, the issuing velocity of water from such a pipe kept constantly full be the same, the momentum in both cases must be equal. We do not see how this consideration proves any inconsistency in our arguments, nor that it gives any countenance to the view taken by our correspondent.

On the next point—the velocity of the water *entering* into the vertical pipe—the whole question may be said to depend. Our correspondent alleges that our "mistake" arises from not considering that the water must enter the pipe as quickly as it issues from it. We maintain, on the other hand, that his error consists in not considering by what force this velocity is imparted to the entering fluid. The water in the reservoir is, by the hypothesis, supposed only just to cover the upper end of the pipe; therefore the action of gravitation on the water between the surface and the top of the pipe can have no perceptible effect. The pipe is also supposed to be constantly full, and the fall of the water down it to be uniform. By what force, then, is the same velocity given to the water in the upper part of the pipe, as to that which has fallen 16 feet? Our correspondent asserts that the velocity of the water at the top of the tube is 32 feet in a second; but we are left completely in the dark as to the nature of the force by which this velocity, which is due only to a fall of 16 feet, can be communicated to the water flowing into the top of the pipe. According to our view of the case, the force which communicates the velocity to the entering water is derived from the action of gravitation on the water falling down the pipe. Part of the force acquired by the water in its fall towards the lower portion of the pipe is communicated to the more slowly moving water above. The tendency to accelerated motion is thus continually checked during the flow of the water by the loss of the motion communicated to the fluid in the upper portion of the pipe, and the accelerated is converted into uniform motion. The laws of dynamics teach, that when accelerated motion is rendered uniform, the resulting velocity is the mean of the initial and final velocities, or one half of the latter; therefore, in a fall of 16 feet, the accelerated motion being rendered uniform, the mean velocity will be 16 feet, which is half the final velocity acquired by a body falling from that height.

In the illustration of the glass tube, when our correspondent says that if the water be not poured in with a velocity of 32 feet in a second, the tube will not be maintained full, he appears to forget that water in pouring only obeys the laws of gravity, and that to pour it into a tube with a velocity of 32 feet in a second, it must fall from a height of 16 feet. In the illustration of the *rope of shillings*, it is plainly admitted, indeed, that in order to obtain a uniform velocity of 32 feet in a second, the shillings must be dropped from a height of 16 feet *before entering the tube*; therefore, even according to our correspondent's own illustration of his case, a fall of 32 feet instead of 16, is requisite to communicate a uniform velocity of 32 feet in a second. We may observe, in passing, that the illustration of the continuous fall of shillings could never be practically exemplified, for we cannot admit that a row of shillings, or of any other non-cohering bodies, would fall in a uniform stream unless they were all allowed to fall at the same instant of time, like a solid bar.

Towards the conclusion of his letter, our correspondent calls Belidor to his aid; and he appears to imagine that thus supported, his position is impregnable. For our own parts we do not see the utility in any course of original inquiry of relying on authorities, however celebrated, as guides where we are professing to take a new road which they have never trodden. If old authorities were permitted to decide new questions, all scientific researches would be limited to the compilation of different and various opinions, and to the decision of their relative values; and we should never advance beyond the present limits of knowledge. The argument of authorities has this further disadvantage, that the opinions quoted very frequently refer to circumstances different from those to which they are applied, and errors thus originating become the more dangerous by the apparent sanction of authorities, which are, if properly understood, opposed to them. The apparent contradictions in the quotations from Belidor, cited by our correspondent, are sufficient to show, either that they refer to different circumstances, or that Belidor had not paid special attention to the velocity of water in vertical pipes, but had, like most other writers, assumed without consideration that the efflux of water from vertical pipes is the same as through orifices. To show the contradictory nature of the opinions to be gathered from Belidor, on the supposition that his words apply throughout to vertical pipes and not to pipes and to orifices alternately, we will quote a passage preceding those referred to by our correspondent. In paragraph 424, he says, when speaking of the cause of the velocity of water flowing through orifices, and contrasting such discharge with the flow of water down vertical pipes, "as the force on the top of the water is absolutely nothing as compared with that at the bottom of an ideal column, corresponding in size with the orifice, it cannot be said that it is this column constantly renewed from the surface which flows out, but that, generally, all the water in the reservoir assists in the discharge through the orifice." He then proceeds to show that if a pipe were inserted in the orifice, and reached to the surface of the water, the exterior of the pipe would bear the pressure of the water in the reservoir, and that the water within the pipe would descend by its own gravity alone, unassisted by the pressure of the other fluid. The circumstances of the discharge in the two cases having been thus distinctly shown by Belidor himself to be so different, he could never mean to assert that the quantities discharged in each case are the same. It must be confessed that he has expressed himself in this part of his work rather vaguely; but M. Navier, who was deputed by the French Academy of Sciences, to superintend the publication of a new edition of Belidor's Architecture Hydraulique, in 1817, adds a note to these passages, from which it clearly appears that he considered Belidor to refer only to the discharge through an orifice, when stating the velocity to be equal to that of a body falling from the height of the fluid.

The authority of Belidor, therefore, would avail our correspondent nothing, even were we disposed to admit that it has any weight in the discussion of a question to be decided by reasoning from facts rather than by opinions. As the flow of water down a vertical pipe is assumed to be uniform, it is evident that there must be some other force than its own gravity which communicates to the water entering at the top of the pipe the same velocity as that which has fallen to the bottom and is flowing out. No attempt is made by our correspondent to show whence this force is derived, though according to his estimate of the uniform velocity, it must be equal to the pressure of another column of water of the same height as the pipe whence it flows. In our view of the case, the velocity of the entering water is derived from the gravitating force of the water descending the pipe; and as the accelerated motion of the falling fluid is thus converted into uniform motion, the velocity can be only the mean of the initial and final velocities of a body falling from the same height.

IRON DWELLING-HOUSE.—A large iron mansion has been built by Mr. W. Laycock, of this town, in separate plates. It is to be sent to Africa, where it will be used as a palace by one of the native kings. This singular building has three floors, exclusive of an attic. The basement story is 7 feet high; the second, 10 feet; and the third, in which is the grand suite of state apartments, is 12 feet high. In these his sable majesty will give his state audiences. The principal reception room, the presence chamber, is 50 feet by 30, and ornamented throughout in a style of most gorgeous magnificence. To counteract any annoyance from heat, the inventor has contrived the means of admitting a current of air, which can be regulated at pleasure, to pass through an aperture left between the outer plate and the inner panel.—*Liverpool Albion.*

TESSELLATED PAVEMENTS,

ANCIENT AND MODERN.

[A work has been recently published, at a great expence, under the direction of Mr. Blashfield, who is connected with the old established firm of Messrs. Wyatt, Parker & Co. the cement manufacturers, for the purpose of exhibiting to the profession what truly beautiful patterns may be adopted in tessellated and mosaic pavements, by the aid of the small porcelain squares recently introduced by Mr. Blashfield for that purpose. The work consists of ten elaborate designs by Mr. Owen Jones, the author of the "Alhambra," splendidly printed in colours. These designs cannot fail in directing the public taste to this admirable description of ornament, for the floors of halls, saloons, conservatories, baths, &c.—we may also add the aisles of churches; for to our taste, it is far preferable to the dingy encaustic tiles. The following essay on the materials and structure of tessellated pavements is by Mr. F. O. Ward who has devoted considerable research in collecting the information.]

THE object of the following notice is to call public attention to a new material for tessellated pavements, and to an improved method of constructing the same, by the adoption of which this ancient and esteemed mode of decoration may be re-introduced, at a moderate cost, for the embellishment of our modern buildings. The improvements in question will, it is confidently believed, enable the modern architect to execute mosaic floorings, equal in point of extent and elaborateness to the most celebrated of the remains that have descended to us from antiquity, and very far superior to these in brilliancy and variety of colouring, in the accurate co-adaptation of the pieces, and in the uniform durability of the surface.

In order to arrive at a just conclusion on this subject, it will be necessary in the first place to bestow some attention on the materials and structure of the old Roman tessellated pavements, as described by Vitruvius, and still to be traced in the remains existing in various parts of the country, and in the specimens preserved at the British Museum.

The materials of the best and costliest pavements at Rome (such, for example, as those still remaining in the baths of Caracalla), are coloured marbles of various kinds, differing considerably from each other in hardness and durability. The inferior pavements, found scattered through Britain, France, and other parts of Europe, and along the northern coast of Africa, are usually made of such coloured stones as the neighbourhood happened to supply, with the exception only of the red tesseræ, which are almost invariably of burnt clay. Thus, in the celebrated Roman pavement which was discovered in 1793, at Woodchester, in Gloucestershire, the grey tesseræ are of blue lyas, found in the vale of Gloucester,—the ash-coloured tesseræ of a similar kind of stone, often found in the same masses with the former,—the dark brown of a gritty stone, met with near Bristol, and in the forest of Dean,—the light brown of a hard calcareous stone, occurring at Lypiat (two miles from the site of the pavement)—and the red tesseræ, as usual, of fine brick. These materials differ from each other in point of hardness even more than the coloured marbles of the costlier pavements at Rome; and it is evident that a surface composed of such heterogeneous materials must wear unequally at different parts, and ultimately fall into hollows wherever colours produced by the softer kinds of stone are employed.

If this remark should be met by a reference to remains of ancient pavements, discovered in this country after a lapse of sixteen centuries from their first construction, and still retaining a level unworn surface, it is obvious to reply, that the mere length of their duration gives no force to the objection, seeing that, during by far the greater portion of the time, these pavements have lain buried; and, further, that even when in use they formed floors to the baths and best chambers of the residences of Roman provincial governors, and were therefore, doubtless, subject to very inconsiderable traffic. The entrance hall of a modern club-house would afford a much more trying test of durability; and it will hardly be disputed that a pavement composed of heterogeneous materials would in such a position be liable to wear unequally.

The next point to be observed with reference to the Roman tesseræ, is the want of uniformity in their size and shape, and the consequent irregularity of their junctures, especially in the more minute portions of the design. Whoever will take the trouble to examine the choicest specimens of old pavements at the British Museum (as, for example, one presented by Mr. Lysons, which formed part of the Woodchester pavement referred to above,) will perceive that the tesseræ, instead of coming into contact by smoothly ground and equal sides, are in many places separated by broad uneven lines of cement. In some parts the intervals are of such width that the cement, which in a good pavement should be scarcely seen, forms at least a fourth of the visible surface. It is scarcely necessary to point out the effect which this net-work of brown cement lines, running through the whole design, and mixing a muddy hue with every tint, must have in diminishing the purity of the colours, and in deadening the sharpness and brilliancy of their contrast. It is much as if a picture, when finished, should be crossed and re-crossed all over with lines of brown paint.

Proceeding from these remarks on the materials of the Roman pavements to consider the mode of their construction, we shall find that, while the effect produced was imperfect, the means employed for its production were costly and inadequate to the end proposed.

Vitruvius, in the first chapter of his seventh book on architecture, after describing the manner in which the foundation of the pavement should be formed, goes on to say, that on the topmost layer of cement the tesseræ are to be laid—care being taken to keep the surface flat and true with the level; that, in the next place, all unevennesses and projections are to be worked down by rubbing and polishing; and that, lastly, a layer of cement is to be spread over the whole and scraped off again (in order, it would seem, to fill up any cavities in the cement between the tesseræ, and to render the surface as smooth as possible all over).[1]

We need not dwell at length on the time and trouble that it must have taken to set each tessera separately in the cement, and to try the surface with the level after every few pieces were laid. With respect to the subsequent operation of grinding down and polishing the surface of the work, it must have been in most cases (and particularly where stones of a hard and gritty nature were employed) the most tedious and laborious part of the process. We shall presently see that all these difficulties are obviated by the employment of the newly invented material and mode of construction, which we will next proceed to describe—taking, however, in the first place, a rapid survey of the various experiments which preceded this invention, and of the successive improvements by which it has been gradually brought to perfection.

About forty years ago, a patent was obtained by Mr. C. Wyatt for a mode of imitating tessellated pavements by inlaying stone with coloured cements. Floors thus constructed, however, were found liable to become uneven in use, in consequence of the unequal hardness of the materials; which defect prevented their general adoption. Terra cotta inlaid with coloured cements has also been tried, and found liable to the same objection.

During the last ten years, cements coloured with metallic oxides have been used by Mr. Blashfield to produce imitations of the ancient tessellated pavements; and, for work protected from the weather, the material appears to have answered tolerably well; but for out-door work, required to stand frost, it has been found necessary to employ Roman cement, the dark brown of which gives a dingy hue to all colours mixed with it. This, with some other practical difficulties, has interfered with the success of the plan.

Bitumen coloured with metallic oxydes has also been tried by Mr. Blashfield as a material for ornamental floorings. The groundwork of the pattern was first cast in any given colour, and the interstices were afterwards filled up with bitumen of various other shades. But this method was even less successful than the former; the contraction and expansion of the bitumen soon rendered the surface uneven; the dust, trodden in, obscured the pattern; and the plan, besides being ineffectual, was expensive.

Three years ago, Mr. Blashfield succeeded in constructing an extensive and elaborate inlaid pavement, on the plan of the Venetian Pisé floors. It was made after designs furnished by H. S. Hope, Esq., at whose country-seat Deepdine, in Surrey, it was laid down. It is still in good preservation.[2]

In the same year (1839) Mr. Singer, of Vauxhall, obtained a patent for a mode of forming tesseræ, by cutting, out of thin layers of clay, pieces of the required form, which are afterwards dried and baked in the usual way. His patent also included an improved method of uniting the tesseræ with cement, so as to form slabs of convenient size for paving. He has executed in this manner some very admirable mosaics, and his invention must be regarded as one of the most important steps towards the revival of the art in this country.

We now come to the discovery which led to the invention of the tesseræ particularly referred to throughout this treatise.

In 1840, Mr. Prosser, of Birmingham, discovered that if the material of porcelain (a mixture of flint and fine clay) be reduced to a dry powder, and

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[1] This is the general sense of the passage according to the best commentators. The phraseology in the original is here very obscure and has probably suffered from the carelessness of early transcribers.

[2] A floor of a very similar kind was laid down at Mr. Hope's mansion, in Duchess Street, about sixty years since, and it is said to be still in excellent condition.

in that state be subjected to strong pressure between steel dies, the powder is compressed into about a fourth of its bulk; it then undergoes a process of semi-vitrification, and is converted into a compact solid substance, of extraordinary hardness and density; much less porous, and much harder than the common porcelain, uncompressed.

This curious, and as it has since proved, very important discovery, was first applied to the manufacture of buttons, to supersede those of mother-of-pearl, bone, &c. The buttons thus stamped out of porcelain powder are capable of resisting any pressure to which they are subject in use, and are more durable, as well as cheaper, than buttons of the materials ordinarily used.

The applicability of this ingenious process to the manufacture of tesseræ for pavements soon afterwards occurred to Mr. Blashfield; who made arrangements with Messrs. Minton & Co. (the manufacturers appointed to work Mr. Prosser's patent), for a supply of small cubes made according to the new process; these he submitted to various trials and experiments, and having found them in every respect suitable for the purpose, he has recently, in conjunction with Messrs. Wyatt, Parker, & Co., carried out the invention on an extensive scale. Tesseræ of various colours and forms—red, blue, yellow, white, black, brown; quadrilateral, triangular, rhomboidal, hexagonal, &c.—have been manufactured on this principle in large numbers; pavements of considerable extent have already been constructed with them; and they have been found to possess the following advantages:—

First, being formed in similar steel dies, they are of uniform size and shape, so that they can be fitted together accurately in the laying down of the most complicated designs. Secondly, being all composed of the same material, variously coloured, they are all of precisely equal hardness, so that pavements made with them are not liable to fall into hollows in use. Lastly, owing to the effect of the intense pressure under which they are made, they are quite impervious to moisture, of a flinty texture throughout, and, in a word, to all intents and purposes absolutely imperishable.

In these several respects, their superiority to the Roman tesseræ, (which, as we have seen, were shaped imperfectly by hand, and differed from each other in hardness,) must be manifest to the reader. Nor less conspicuous is the superiority of the modern process of uniting the tesseræ to form pavements.

For this purpose (instead of spreading the cement on the surface to be paved, and laboriously setting each single tessera in it, according to the directions of Vitruvius), the pavement is first put together, face downward, on a smooth surface, so that the tesseræ find their level without any trouble to the workman; and as soon as a sufficient portion of the design is finished, it is backed with fine Roman cement, which is worked in to fill the crevices between the tesseræ; the pavement is thus formed into smooth flat slabs of convenient size (according to Mr. Singer's method), and these are laid down on a foundation properly prepared in the usual way.

One peculiar feature of this process is, that private persons, if so inclined, may set out their own pavements in the coloured tesseræ, leaving it for a workman afterwards to cement and lay down the slabs. Fine mosaic work for the tops of tables, for illuminated monuments, &c., may be made in the same manner with a superior kind of tesseræ, glazed on the surface, and richly ornamented in gold and colours.

Pavements thus constructed are singularly beautiful. The outline of the design strikes clearly and sharply upon the eye, and the brilliant colours of the tesseræ are reflected from the level surface, uninterrupted by those broad uneven lines of cement, which in the Roman pavements detract so much from the general effect. The truth of every line and angle in the figure, and the just proportion of all its parts, however complicated and various, impress the mind with an agreeable sense of order and precision. Such, indeed, is the exactness and facility of the workmanship in these pavements, that the oblique and intricate intersections of the Mauresque designs are as readily executed as the simple rectangular patterns of the Pompeian style. Even the scrolls and twisted guilloches, the quaint emblematical devices, and grotesque representations of horses, warriors, &c., found in the most elaborate of the Roman pavements, may be accurately imitated with the new stamped tesseræ.

The Roman designs, however, have little to recommend them to the modern artist, beyond their historical interest. Even the earliest of them, which are the best, were produced subsequently to the Roman invasion of Greece, when art was everywhere declining; and they abound with indications of the extravagant and licentious taste which grew up amidst the general corruption of Roman manners, occasioned by the rapid influx of foreign wealth and foreign habits of luxurious excess.

When designs after the antique are required, the elements of them should rather be sought in the beautiful decorations of the Etruscan vases, and in the admirable remains of Greek art in general, during its best period—*i. e.* from about 400 to 200 B.C. or during the time of Phidias, Praxiteles, and their immediate successors. (Such are the models which have guided the composition of the magnificent tessellated pavement designed by Mr. Barry, and executed under his direction by Mr. Singer, for the hall of the New Reform Club; a pavement so beautiful and so generally admired, that it can hardly fail to give an impulse to the re-introduction of mosaic decoration, hitherto so sparingly employed by modern architects.)

For Mauresque designs, the mosaic dados of the Alhambra may be advantageously consulted. They are executed in glazed earthen tiles, variously coloured, shaped with considerable exactness, and joined with cement. They present many examples of ingenious arrangement and well-contrasted colouring.

But, whichever of these various styles the architect may adopt, he will find that, for the realisation of his conceptions, there is no material which presents so many advantages as the compressed porcelain tesseræ—whether on account of their uniform size and shape—the purity and brilliancy of their colours—or their extreme hardness, and unalterable durability.

NEW CHURCHES.

[At the request of several architects residing in the country, we give the following "*Suggestions and Instructions, as amended May,* 1842," of the "INCORPORATED SOCIETY FOR PROMOTING THE ENLARGEMENT, BUILDING, AND REPAIRING OF CHURCHES AND CHAPELS."]

1. *Site.*—Central, with regard to the population to be provided for; dry; if possible, rather elevated, but not on a high or steep hill:—not near nuisances, such as steam-engines, shafts of mines, noisy trades, or offensive manufactories;—accessible by foot and carriage-ways, but not so near to principal thoroughfares, as to subject the service of the church to the danger of being incommoded by noise. The building to stand east and west as nearly as possible.

2. *Style and Form.*—No style seems more generally suitable for an English church than the Gothic of our own country, as developed in its successive periods. The Norman (or Romanesque) style is also suitable, and offers peculiar advantages under certain circumstances, especially when the material is brick. The Society earnestly recommend that, in the proportions and great features as well as in the details, good ancient examples should be closely followed.

For Gothic churches, the best form is either the cross, consisting of a nave, transepts, and chancel, or the double rectangle, composed of a nave, with or without side aisles, and of a chancel. In a chapel, the single rectangle is also suitable: the length being *at least* twice as great as the breadth. If the funds do not suffice to complete satisfactorily a design, otherwise eligible, or if the circumstances of the neighbourhood render it probable that, at no great distance of time, the building may be enlarged; it is better to leave a part of the original design, as, for example, side aisles or transepts, to a future period, than to attempt the completion of the whole design at once in an inferior manner. In such a case, the temporary walls and fillings up of arches should be so built, as clearly to show that they are temporary, and that the building is incomplete, but at the same time not without due regard to ecclesiastical propriety.

3. *Foundation.*—To be surrounded, if requisite, by good covered drains. If the soil wants firmness, the walls may often be better secured from partial settlements by spreading the footing on each side, than by deepening the foundation, or resorting to more expensive works.

In all irregular or doubtful soils, concrete is recommended for the foundations, in preference to any other material.

No interment should be permitted under a church, except in arched vaults properly constructed at the time of building the church, with entrances from the outside only; nor should any graves be made within 20 feet of the external wall.

4. *Area.*—It would tend much to the preservation of churches, and render them more dry, if a paved opened area, not less than 18 inches wide, were made round them, and sunk 6 or 8 inches below the level of the ground about the church, with a drain from the area to carry off the water. Or the same objects might be attained either by turning a segmental arch from the wall outside the footing, or by bedding in the wall a course of slate in cement.

5. *Basement.*—The inequalities of the ground, the dampness of the soil, &c. often render it desirable to have crypts under a church. They should be of a massive construction, turned upon semicircular or segmental arches, resembling the early examples, entered only from without.

6. *Floor.*—To sittings, wood; to open spaces, or chancel, stone or encaustic tiles. If not undervaulted, it may be freed from damp by brick rubble, flints, ashes, or furnace slag, laid to the depth of 12 or 18 inches under the floor. Allowance should also be made for the future rise of the surrounding burial ground; the floors of many churches, originally above ground, are at this day many feet below the surface, and have thereby become damp and unwholesome. It is desirable that the church floor should be raised at least three steps above the ground line.

The distance between the joists of the floor should never exceed twelve inches.

All wood floors should be supported on walls, with a clear space of eighteen inches in depth, well ventilated beneath.

No American timber to be used either in the floors or any other part of the building.

Flagged floors should be laid on cross walls eighteen inches high.

7. *Walls.*—To be solidly constructed of stone, either squared, or rubble, or flint; or of brick, where no good stone can be procured without great additional expense. If the walls are of brick, cased with stone or flint, the stone or flint to be well bonded into the brick. As a general rule the thickness must not be *less* than as follows:—

	Square stone of the best quality, or brick.	Brick faced with Flint or Stone.	Inferior stone, Flint, or Rubble.
	ft. in.	ft. in.	ft. in.
If less than 20 ft. high, and carrying a roof not exceeding 20 ft. span	1 10½	2 0	2 3
If 20 ft. or more high, or carrying a roof exceeding 20 ft. span	2 3		
If more than 30 ft. high	7½	2 9	3 0

The above dimensions are given on the supposition, that there are buttresses, of solidity and form suitable to the style adopted, placed opposite the trusses or principals of the roof; where there are no buttresses, the thickness of the walls must be considerably greater.

No cement or plastering of any kind to be used as a facing of the walls, or of any external part of a church or chapel.

If a wall be built with two faces of stone, filled between with rubble, great care must be taken that they be properly bonded together, as the wall will otherwise not stand a partial settlement. Where good stone is scarce, a thickness, otherwise perhaps unattainable, may be secured by this method of construction.

Walls built of flint or rubble should have bonding courses of stone or brick, and stone or brick piers at intervals, approaching at least within four inches of the external face.

Whatever be the material of which the substance of the walls is made, the dressings should, if possible, be invariably of stone.

The greatest attention should be paid to the quality of the mortar used.

8. *Roof.*—The best external covering is lead, which should be not less than seven pounds to the foot;—or copper of not less than 22 oz. to the foot. Blue tiles, commonly called Newcastle tiles, or stone tiles, are perhaps the next best covering. Westmoreland slates are better in colour than those commonly used, but are, in most cases, expensive. All slates to be fixed with copper nails.

Flat ceilings are inconsistent with Gothic architecture. Next to a stone vaulted roof, none has so good an effect internally as an open roof, exhibiting the timbers. It is desirable that this should be of high pitch, the transverse section forming or approaching to the figure of an equilateral triangle.

If a wooden panelled roof be preferred, the panelling should not be made to imitate stone.

In roofs of low pitch and wide span, horizontal tie-beams are necessary; but in other cases, where the Society is satisfied that due provision has been made for the safety of the construction without them, they may be dispensed with.

If the distance between the principal trusses exceed ten feet, intermediate trusses must be introduced. The distance between the common rafters should never exceed twelve inches.

Wherever the ends of timbers are lodged in the walls, they should rest in cast iron shoes or on stone corbels.

9. *Windows.*—In Gothic churches, where stained glass is not used, the glass should be in small panes, those of a diamond shape being generally preferable.

Hopper casements are recommended, and they should be inserted in almost all the windows, in order to secure due ventilation.

Where lead lights are adopted, copper bands to tie them to the saddle bars are preferable to lead, being less liable to stretch and become loose by the action of the wind.

The very unsightly appearance often occasioned by the wet streaming down the window backs, can be prevented by fixing a small copper gutter at the bottom of each lead-light, to receive the moisture produced by condensation, with copper tubes to convey the same to the outside of the building. This has also a tendency to keep the building dry, and to preserve it from decay; or the inside of the sills may be raised an inch and a half.

A good effect will be produced by keeping the sills of windows raised as much as practicable above the line of the tops of the seats.

10. *Tower and Spire.*—The usual place of the tower, in a church without transepts, is at the west end; or it may be placed about the middle of the side. If funds are scanty, it is better to leave this part of the church to a future period, than to attempt its immediate completion in an inferior manner.

When the tower contains more bells than one, the timbers of the bell framing or floor should not be inserted into the main walls, but should be supported either on set-offs or on corbels.

11. *Gutters.*—Where necessary, to be most carefully constructed to carry off the rain and snow into the perpendicular pipes, which are best of cast iron, cylindrical, and placed an inch or two at least from the wall, so as to admit air and keep it dry.

Dripping eaves projecting very far do not in all cases supersede the necessity of gutters and pipes, even in very sheltered situations: but in exposed places, eaves-gutters, and rain-water pipes will be absolutely necessary to prevent the wet being driven against the walls, and thus rendering the building damp.

Eaves gutters may be made of cast iron; but, unless very skilfully cast, they will not preserve their level.

The lead for gutters must not be less than eight pounds to the foot.

Lead gutters must not be less than twelve inches wide in the narrowest part, with drips at proper intervals; each drip two inches deep at the least, and the fall between the drips not less than one inch and a half in every ten feet.

Outlets to be provided in parapets to carry off the overflowing occasioned by rapid thaws or otherwise.

Drains on the roof should be protected by coverings, as it prevents the melting snow from congealing in the gutter, and thus obstructing the water-course.

Drains should be formed at the feet of all the rain water pipes.

12. *Ventilation.*—Ventilation cannot be always completely effected by windows alone, without incommoding the congregation. In such cases foul air may be expelled at or near the roof, either by horizontal or perpendicular channels or tubes.

Where there is a ceiling, apertures should be made in it for the proper ventilation of the roof.

All the original provisions for the ventilation of the building must be carefully looked after, and the apertures kept open.

13. *Chimneys.*—If any be required, the utmost care must be taken to render them safe from fire. They should never be brought within eighteen inches of any timber. They should be as unobtrusive as possible, but not disguised under the form of any ornamental feature of the building.

14. *The Lord's Table.*—Should be raised two or more steps above the floor of the chancel, which should itself be raised a step or two above the floor of the nave. Where the rails do not extend across the chancel, no seats should be allowed between the rails and the north and south walls; and as much room as possible should be left about the rails for the access of communicants.

15. *Font.*—To be fixed at the west end of the building, or as near as convenient to the principal entrance, but not so as to be under a gallery. Care to be taken that sufficient space is allowed for the sponsors to kneel. The font to be of stone, as directed by the Canon, and large enough to admit of the immersion of infants. To be provided with a water drain.

16. *Reading Pew and Pulpit.*—The reading pew should not be so elevated as to resemble a second pulpit; and both reading pew and pulpit should be so placed as to intercept the view of the east end as little as possible from the body of the church.

17. *Seats.*—The seats must be so placed as that no part of the congregation may turn their backs upon the altar. There must invariably be an open central passage up the whole length of the church, from west to east. No square, or round, or double pews can be allowed, and as few pews as may be. Much accommodation is gained by the adoption, instead of pews, of open seats with backs.

The distance from the back of one seat to that of the next must depend in great measure on the height of the backs and the arrangements for kneeling. Where the funds and space admit, convenience will be consulted by adopting a clear width of 3 feet, or even 3 feet 4 inches; but the width of 2 feet 6 inches in the clear may be allowed if the back of the seat be not more than 2 feet 8 inches in height. This height is in all cases to be preferred, both for convenience and for appearance. If a greater height be adopted, the distance from back to back must not be less than 2 feet 11 inches in the clear. There should not be any projecting capping on the top of the backs. Means for kneeling must in all cases be provided. Hassocks are to be preferred to kneeling boards, especially where the space is narrow.

Twenty inches in length must be allowed for each adult, and fourteen for

a child. Seats intended exclusively for children may be twenty-four inches from back to front.

18. *Galleries.*—None can be permitted in any part of the chancel. Where necessary, they should not enclose the columns against which they rest, so as to break the upright lines of the shafts from the floor to the roof. Wherever placed, they should, as much as possible, be made to appear as adjuncts and appendages to the architectural design of the interior, rather than as essential parts or features of it. The Society will not sanction any plan involving the erection of a gallery, unless in cases where it is distinctly shown that no room is unnecessarily sacrificed, by inconvenient arrangements, on the floor.

19. *Vestry.*—The vestry should have access to it from without.

20. *Finishings.*—Wall wainscoting, or wood linings to walls, to be avoided wherever convenient. Wood linings to walls confine the damp, and frequently occasion dry rot. For the same reason cement skirtings are to be preferred to wood, particularly on the ground floor. Where the linings to the walls are of wood, holes should be perforated under the seats to allow the circulation of air. As it is scarcely possible to prevent rot if any wood is in contact with the walls, the ends of seats next the walls should be omitted, and cement, painted, be substituted.

21. *Exciseable and Customable Articles.*—Architects are particularly desired to take care that an accurate account be kept of the quantities of customable and exciseable articles used, where the expense of enlarging or building a church or chapel will amount to £500 or upwards, such as may be duly certified or verified by affidavit.

MR. VIGNOLES' LECTURES ON CIVIL ENGINEERING, AT THE LONDON UNIVERSITY COLLEGE.

SECOND COURSE.—LECTURE XXIV. AND LAST: FOR WHICH WE ARE INDEBTED TO THE "MINING JOURNAL."

Before proceeding to a summary of the second course, Mr. Vignoles observed, that there was a material point connected with the subject which had not been sufficiently discussed—viz. the motive power to be employed; on this greatly depended the principles on which a line of railway should be laid out, the end and object being to convey the greatest extent of traffic at the least cost: this cost was compounded—first, of the interest of the capital expended, which should be considered a constant charge; and second, of the periodical working expenses—the work to be done being summed up in the general expression of "overcoming all obstacles to facility of motion." What are these obstacles? They might be divided into two great heads—Gravity and Friction. 1st. Gravity is a natural cause existing under all circumstances, and, affecting lines deviating from the horizontal, in direct proportion to the sine of the angle of inclination. Engineers, therefore, have considered that the first principle in laying out roads, should be (under limits) to approximate as nearly as possible to the horizontal, in order to exclude one of the great causes of obstacle: since, with maximum loads, the retardation arising from gravity is most felt. When such could not be effected, then to distribute the total rise (or effect of gravity) along the easiest ratio of slope. But, in practice, the occurrence of maximum loads, in ordinary passengers and merchandise traffic, forms the exception, instead of constituting the rule, and it is only when a regular and constant heavy trade is to be anticipated that horizontal communications should be insisted on. 2nd. Friction, is a physical cause, varying according to the perfection of the road and of the vehicles moving on it. In the practical working of a railway, however, so many expenses arise under the heads of "conducting traffic, management, &c." common to most lines, whatever the gradient, that they tend to make the cost of overcoming friction and even gravity (particularly with the ordinary light loads) but a small fraction of the total charges. Comparing the amount of obstacles on a railway with that on the ordinary road (where the friction, meaning thereby axletree friction and surface resistance, may be called sixteen to twenty times greater than on a railway), and assuming the inclination on railway and road to be the same, the general result is that the perfection of the railway surface moved over, and the improvement of carriages, or rather that of their wheels and axles, cause the effect of gravity to be felt in the most sensible degree on railways; while the imperfection of the road causes it to be comparatively scarcely appreciated. Hence with the wretched surfaces of the old roads, and the clumsy wheels of our primitive vehicles, the hills seem to have scarcely added to the obstacles to be overcome. As the road surfaces and carriages improved, and increased speed and heavier loads were introduced, the necessity for the greater perfection of the ordinary road became apparent, and the remedy was applied in various degrees during the last 100 years until it was completed as far as possible, in the extensive improvements by Telford and Macneill on our great ways. But in carrying out this principle on railways we have run into the opposite extreme. We should first take in one sum the retarding causes of gravity and friction—viz., the friction, being constant, or nearly so, putting aside the resistance of the air at high velocities, varying only in the perfection of the wheel axles, and in the mode of lubricating, (the surface resistance on railways being, practically speaking, nothing), and the maximum gradient, or rather the gravity due to it:—their sum will be the constant divisor for the motive-power, of whatever description that motive power might be; and, in considering the latter point, it must be the distribution of the traffic, or what may be called the average hourly load throughout the year which is to determine the question. In many instances, in this point of view, it would probably often be found most economical to use animal power, (as is done on the Edinburgh and Dalkeith Railway), were not velocity required—which, on railways, enters so materially into the calculation, that mechanical power in some shape becomes necessary; and this divides itself into stationary power, or when the mechanical means are fixed, and locomotive power, or when the machine travels along with the load. There are two serious difficulties connected with the latter system;—first, a great addition to the load, equivalent on the average to doubling it; and next, that the fulcrum through which the motive power must be transmitted—that is, the rail on which the locomotive driving wheel impinges—is greatly affected by atmospheric causes, occasioning great variation in the adhesion, and consequent uncertainty from slipping of the wheel, so that, as explained in a former lecture, the load after a locomotive engine is really limited by its adhesive power, and not, as might at first be supposed, either by the cylinder power or boiler power. Considered abstractedly, stationary power is cheaper, and always would be so if the traffic were certain and regular, with maximum loads and very moderate speed, even with the present obstacles of ropes, sheaves, and all their contingent complicated apparatus; but at high speed, with a great length of rope, the experience of the working of the Blackwall Railway has shown that for passenger trains only, there was, compared with the most expensively worked lines on the locomotive system, to say the least, no economy in the motive power, though other conveniences arising from the peculiar arrangements on that line, were, perhaps, in this special case, more than an equivalent. A most serious obstacle to stationary power, was the necessity of absolutely stopping, and disengaging and refixing, the trains at each station, which stations could not be conveniently, and certainly not economically, placed further apart than three or five miles, for it could readily be proved, than on a continued distance of six or seven miles of railway worked by a rope, the power of the largest engine that could well be erected, would be absorbed in moving the rope only. The Professor then went largely into a consideration of applying stationary engines as the motive power in working inclined planes under a variety of circumstances, and recommended to the students to consult the valuable work of Mr. Nicholas Wood on this subject, and indeed on all the details of railway working, of which, particularly in the third edition, there was most of the latest information. In many situations, however, where water power could be obtained, the stationary rope and pulley system might be advantageously introduced. Gravity became the motive power, on what were called self-acting inclined planes; that is, when the gravity of a descending train of laden carriages brought up a train of others empty or partially laden; or where skeleton wagons, or water tanks on wheels, could be used as artificial counterbalancing weights in either direction alternately; the circumstances under which self-acting inclined planes could be properly introduced were rare. Mr. Vignoles then gave a clear account of various modes of working self-acting inclined planes; among these was described a curious and interesting one near the great limestone quarries in North Staffordshire; another on the St. Helen's and Runcorn Gap Railway, which he had himself put up, and also the planes for the Great Portage Railway, across the Alleghany Mountains, in the United States of America. Stationary power might also be used to a greater extent on the atmospheric system, whereby, to speak metaphorically, a rope of air was substituted for a rope of hemp or wire, and where no pullies were required, nor any necessary stoppage at the intermediate engines, where only the carriages had to be moved, and where nearly the whole dynamic force generated was made available for motive power. This system had already been explained to the class, and practically illustrated on a railway thus worked, and need not be further alluded to. The Professor was preparing for publication a separate lecture "On the Atmospheric Railway System," to be illustrated with plates, and tables, and appendices, in which that interesting subject would be fully gone into, and all the mathematical and philosophical investigations given, with estimates of the cost of such railways under various circumstances of traffic and gradient; fully enabling the value of the principle, as a motive power, to be appreciated. Although modern practice had almost discarded the use of animal power from railways, it might be proper to refer cursorily to it. A horse seems adapted to drag vehicles, from the mode in which he adjusts his muscular action, so as to throw the greatest effect on the line of draft; in making an effort to draw a carriage, the body of the animal is bent forward, throwing upon the latter the part of its weight necessary to overcome the resistance, the muscular force of the legs being employed in keeping up his traction and moving the

body onward; the effort of the animal being resolvable into these two parts—viz. the action on the load, and that required to move itself by. It may be gathered from writers on this subject that the force a horse is capable of exerting, is that equal to about one-seventh or one-eighth part of his own weight: or that, on an ascent of one in seven or one in eight, the exertion required to overcome his own gravity, is a force equal to that he is able to exert on a load on a level plane. Taking the average weight of a horse, and considering that he is capable of occasionally exerting great extra power on the load, still it seems to be satisfactorily ascertained, that nearly seven parts out of eight of the muscular power of a horse is required to drag his own weight forward, leaving, of course, only one part applicable to the load. But the criterion of a horse's power in practice is not the occasional effort of which the animal is capable at a dead pull, or for a short period: we must estimate his strength by what he can do daily, and day after day for a long period, and without breaking him down prematurely. If a horse is to travel at the rate of 10 miles an hour, his power of pulling is greatly diminished, and he can work only an hour or so in the day: at two miles an hour he may give out a power of 150 lb. on the load: at 10 miles he has scarcely 35 lb. to spare, and at 12 miles an hour, he can seldom be expected to do more than move himself. This was on the average of horses—all beyond were exceptions Thus, the application of horses to railways as the motive-power was very limited: and in laying out lines where they are to be used, to full effect, gravity should be arranged to be always with the load, or, at least, not against it: the rate of travelling only 2 or 2½ miles per hour, and the traffic uniform. Mr. Vignoles proceeded to an interesting comparison between locomotive and stationary power up inclined planes, taking the inclination of 1 in 50 as a maximum, and showed that *when the traffic was small, and the loads consequently comparatively light, and the daily number of trains not great, locomotive engines*, as the motive-power, (taking into consideration all circumstances of first cost, and working expenses—particularly the latter, of which the locomotive power was but a small part), *would not be so expensive as stationary engines*, while they would be certainly more convenient; and that, with all the best modern improvements in the locomotive engines, the system of working with large cylinders using the steam expansively on the level and falling parts of the railway improved boilers, &c., *planes of 1 in 50 might be practically worked*: the only material drawback being, occasional slipping of the wheels on the ascent and the necessity of great caution and careful application of the brakes on descents; but on the whole, the balance, *under the above circumstances*, was much in favour of the locomotive system. The Professor then entered into a very long and minute comparison of the present system of working the Blackwall Railway by stationary engines, with ropes and pullies, with what would be the case if the motive power were locomotive engines—and by tables, showed that while the working of the Blackwall Railway (3½ miles) on the stationary system, was costing about *seventy-two pence* per mile per train, the cost of working the Greenwich Railway (3¾ miles) was only about *forty pence*:—but, Mr. Vignoles admitted, that by the former, great accommodation to the public was afforded by the numerous intermediate stations, while on the latter, there was only one stoppage. In concluding the general comparison between the two principles of mechanical motive-power, the Professor observed that on the locomotive system, a minimum of power need only be provided in the first instance and the number of engines might be increased gradually as the traffic required, which was a great consideration when the first expenditure of capital had to be kept down to the very lowest terms, at all future risks. On the stationary system, provision had to be made, from the outset, for the maximum anticipated trade, which of course increased the first outlay on the railway establishment, and depended on the ultimate economy of future working to make up the difference. Having concluded the notice of various descriptions of *motive-power* employed on railways, of which the preceding is but a mere outline, some general remarks were made on the principles of laying out railways, in reference to the several systems respectively.

In a concluding general summary, Mr. Vignoles observed, that in his first course, at the latter end of 1841, he had fully considered the practical rules for earthwork and constructions:—these were not peculiar to railways, the theory and practice of bridge-building, applied to all internal communication, and would be most conveniently considered in a separate illustrated course, but he wished to recall to the class generally, that in proceeding to lay out railways in the first instance, the engineer ought to enter much more deliberately into those previous inquiries, so absolutely necessary, than had hitherto been done. A system of applying the same general rule of perfect gradients alike to lines, of the least as well as of the greatest traffic, had too much prevailed, and until more rational ideas were substituted, the public would shrink from embarking in enterprises subject to all the contingencies of extra cost beyond estimates which had characterised almost every railway in this country. *The earthwork and its consequences*, regulated the cost, particularly as regarded contingencies, and the utmost consideration should be bestowed as to how far it was justifiable to encounter the expense of these operations. The average cost of earthwork, and all consequent works of art, &c., on the English railways was nearly £15,000 per mile, or about 50 per cent. of the whole capital expenditure. Mr. Vignoles was decidedly of opinion that in *all future lines in this country, and particularly on the continent*, the corresponding outlay *ought not to exceed £5000 per mile*, and that beyond that sum perfection of gradient would be bought too dearly. In reference to the *gauge* of railways, Mr. Vignoles stated, distinctly, that theoretical investigations and practical results led him to consider a six foot gauge the best; but the present 4½ foot gauge was certainly rather cheaper. In respect of *curves*, he observed, that they were much less disadvantageous than had been first supposed: that a half mile radius was now everywhere admitted; and that he himself did not hesitate to adopt a quarter mile radius whenever expense could be materially saved; and if the atmospheric system of motive power should be found to succeed on a large scale, the curves might, on lines thus worked, be safely made still sharper. In regard to the systems of constructing the *upper works*, he had in a recent lecture, entered so fully into the comparison, that he need only now say, that if the expensive and complicated system of heavy rails and chairs, and cross sleepers, were preferred by engineers, then the ingenious improvements of Mr. May, of Ipswich, in chairs and fastenings, applied by Mr. Cubitt on the South Eastern (Dover) Railway, with great care in laying, draining, and ballasting, made *that system* perfect and complete. The Professor, however, decidedly gave the preference to the less costly, and the more simple system of lighter rails, without chairs, laid on continuous longitudinal balks of timber of sufficient scantling, and fastened on Evans's principle, modified in the manner shown by the models exhibited to the class: and several engineers were adopting this opinion. On the continent of Europe, where iron was dear, and timber cheap and abundant, Mr. Vignoles calculated *a saving of full £2000 per mile of double road would accrue from the adoption of the latter system*—which offered a vast national economy. In reference to the subject of working drawings, plans, and sections, the Professor reminded the class of the importance he attached to having all such previously made out on a large scale, that the cubic quantities might be accurately obtained, and the just prices considered; and thus, in proceeding to make the estimates, nothing would be left to conjecture, and as little as possible left to be afterwards altered. The period of time for the execution of the works should be extended as far as consistently could be done. The two great sources of the extra expenditure on railways had been, the extreme haste with which the works had been pushed on, and the changes of every kind from the original designs. These points being all carefully considered, *even before the plan was brought before the public in general*, the estimates might be better depended on. Mr. Vignoles then went through all the great items of expenditure generally arising on first construction, and explained how the accounts of measurements should be made out and kept under very distinct general heads, subdivided into minor items, from the purchase of the land to the last finish to the stations, and the entire fitting up and furnishing of the carrying establishments. Sufficient experience had been attained in all these matters to enable the engineer, in future, if the above rules were faithfully followed out, to place himself beyond all chance of reproach for making erroneous estimates. In conclusion, the Professor observed, that he had selected *railways* at the request of the class, as the theme for the course just concluded; but although so much consideration had been given to the subject, he had only been able to touch in a very general way upon the chief points; yet it was to be hoped a sufficient idea had been given of the principles of construction, and of their general application, to create an interest in their minds. Should any of the students hereafter be employed to execute a railway, he trusted they would recollect these lectures with advantage, while they would also probably better understand and appreciate them: at the same time, he must not neglect to impress upon them, that it was not at the college, in the lecture-room, or even in the office of an engineer, that all the duties and knowledge necessary could be taught: the young aspirant must pass much time in the work-shop, indeed, he must become a workman, and acquire the use and skill in the handling of tools, and the erection of mechanism of every kind—and passing to the actual works, ought to learn to be able to direct personally the labour of the mason, the carpenter, and the smith. "Above all," said Mr. Vignoles, "the student in engineering must carry into life with him the constant remembrance of what I have so repeatedly enforced, that the reputation of an engineer in this country is based upon the success of his works, of his mechanism, and of all the efforts of his mind and hand, in respect to, and in proportion to their being productive of commercial and beneficial results, to those who, at his suggestion, may undertake to provide the necessary funds: and he should consider how this result can be best obtained, rather than study the splendour of his undertakings. It is for the architect to attend to the decorative and the beautiful; it is sufficient for the engineer to study proportions, and rely on the simple grandeur of his works as a whole. It is related that Napoleon once observed to the celebrated Carnot, "*Les ingenieurs doivent toujours avoir des idées magnifiques*;" this is true as to their first conceptions, but in the realization, they must be sobered down by the rules of economy and judgment. After the first burst of talent, after image and form has been given by the

hand to the bright idea emanating from the brain, let it be brought down to practical application only after a strict inquiry into the cost. Remember what I quoted on a former occasion, when contrasting the two celebrated light houses, the *Eddystone*, and the *Cordouan*—no unfit emblem of the two celebrated engineers who erected them may I venture to add of their respective nations—remember, I say, "*'tis use alone that sanctifies expense.*"

ROYAL ACADEMY.

Professor Cockerell's Lectures on Architecture.

(From the Athenæum.)

Lecture V.

The love of fine art, and the lively discussion of its principles, which occupied the wits and the courts of Italy in the 15th and 16th centuries, employed the solitary reflections of literary philosophers in the 18th; and in 1730, Baumgarten suggested the title of æsthetics, by which these studies have been designated ever since, and many works remarkable for ingenious criticism, learning, and taste, have resulted. These may be ranked in two classes. The first resolves the questions of taste directly into an original law of our nature, implying senses by which the qualities of beauty and sublimity are perceived and felt as their appropriate objects; it is this species of hypothesis to which artists and amateurs chiefly resort. The second class of hypothesis arises from the opposite view of the subject: resisting the idea of any new and peculiar sense distinct from the common principles of our nature, this class supposes some one known and acknowledged principle or affection of the mind to be the foundation of all the emotions we receive from the objects of taste, and resolves them into some more general law of our intellectual or moral constitution. Thus Socrates and Hume, and others, resolve them into our sense of utility—Aristotle and St. Augustine, into order and design—Diderot and Allison into relation and association. But though in such discussions we recognize many truths, the partiality of individual views renders them often dangerous.

When a philosopher can find
Some fav'rite system to his mind,
In every point to make it fit,
He'il force all nature to submit.

Language itself fails in defining those phenomena which elude ordinary observation, and even when it approaches definition, the measure of quantity, and quality, and circumstance, can alone be adjusted by the magician genius.

The æsthetical principles of architecture, as handed to us from the Greeks by Vitruvius, concur with the notions of ancient philosophy, and have not been controverted by the modern; and though subjected of late years to some rude attacks, they have never been superseded, and we can follow no better text-book in the consideration of our subject. Those principles apply to every style and invention of architecture which the world has hitherto known; they belong to our physical and intellectual nature, and will never change but with an alteration in these.

When the works of Vitruvius were first discovered, they were accounted a revelation to the craft, and called "divine" by Sulpitius, the first translator; and, nearly 200 years after, Perrault, in his translation, calls them "a very singular piece, and an inestimable treasure in the opinion of the learned." Eighteen translations, in 41 editions, are enumerated to this day. In 1807 the philologist Schneider republished Vitruvius. "My whole scope," says he, "has been to purify the text, so as to enable men learned in art to reconstruct and understand the theories of Vitruvius, hitherto obscured by interpolations and vicious translations." But he detracts from the merit of his work by a severity of criticism, as uncandid as it is derogatory to the character of his author. He declines his apology, as "writing neither as an accomplished philosopher, an eloquent rhetorician, nor as an expert grammarian, but as an architect, laying down rules useful to those who build." He calls his language obsolete and plebian, accuses him of pride and envy, and rates him as a morose, inept, infirm old man, querulous and vulgar. But Schneider was the less justified in such treatment, as being weak upon those points in which his author was most strong, for he says, "on architectural subjects, or that which has to do with the subtleties of the art, and the questions and disputes concerning them, I neither could nor would have anything to say." So that the science has received no direct advantage from the labours of Schneider, and yet how much was to be done might be understood by ten discoveries in confirmation of the theories of Vitruvius, made within a few years, and chiefly by Englishmen, cited by the Professor in his previous course on the literature of the art. Such discoveries suggested the desirableness of a new English edition of Vitruvius, as highly honourable and useful to this country. The last, by Mr. Gwilt, is a very useful one.

The slanders of Schneider had been adopted in this country with little honour to the parties, and no advantage to architecture. Vitruvius remained the father of our art, and was entitled to your respect, as the text-book of our studies.

Having been appointed surveyor to the warlike engines and stores of the empire by Augustus, Vitruvius was endowed with leisure; and very probably was instructed to collate the Greek authors on our art, whom he enumerates, and who were collected and deposited in the magnificent library instituted at that period. He appears then with singular advantage as transmitting the well digested and received principles of the greatest masters who had thought and written on architecture, to modern times; and the principles thus derived directly from the Greeks merit our closest attention.

But a few preliminary observations on external forms, in detail and in general, were to be made. The universality of certain primordial forms in all styles, favours the notion of innate ideas, the cube, the sphere, the ellypsoid in solids; the lozenge, the wave, cymarecta, and cymareversa, the serpentine, the ovalo, the spiral, the volute, gradation or diminution of forms, are common to the art of all times and people.

The pyramid is universal, from the compressed to the acute. Such is the charm of the pediment, that "in heaven, where we may not suppose it to rain," says Cicero, "the pediment will surely be found;" so in mountains, trees, and fixed bodies, in which the laws of statics are observed, the pyramid prevails; except in those forms in which dynamics demand a different structure. The pyramidal inclination of the sides of buildings observed in Egyptian, Hindoo, Gothic, and Mexican architecture, has, by the happy discoveries of late years, been proved to exist in Greece also; and the inclination of the axis of the columns at the sides of temples (enjoined by Vitruvius, lib. iii. c. 3, long disputed,) is now beyond all doubt, and the pyramidal inclination to building is proved to be an universal principle.

Gradation of columnar forms, as in the limbs of animals, and in vegetable productions, is universally approved; the cylinder, the leg of an elephant, are justly repudiated: "small by degrees, and beautifully less," has been denied by an eminent critic (P. Knight), "because," says he, "the same is large by degrees, and beautifully bigger;" but however smart the reply, it does not controvert the principle. It is, however, to be observed, that such forms should diminish *from the eye*, as a column does above the horizon, and the leg of a chair or table below it.

The Doric cymatium, the cymareversa, the ovalo, the cavetto, or hollow, are all calculated to express strength, as robust, and appearing to sustain. The Lesbian cymatium, the cymarecta, in all its varieties, has not the same purpose, (namely, to sustain,) and is suited to the more elegant orders. The principle of the application of mouldings for beauty, is the opposition of the curved to the straight surfaces, as well for light and shade as form; and for proportions and oppositions of such forms, constitute the art of profile—a most difficult grace of architecture; for by this, that variety of form and grace may be given which the primary architectural masses and proportions do not admit of. Variety in the *details of sculpture and profile is essential* to the relief of that rigorous geometrical order, which the larger features of architectural composition impose: in all the arts, and even in architecture, variety is an all-important principle, provided the masses are undisturbed. Shakspeare describes Cleopatra as chiefly admirable for this quality:

Age cannot wither her, nor custom stale
Her infinite variety.

The Greek profile is general (more particularly in the Parthenon) is incalculably superior to any other in gradation, quantity, delicacy, and expression, and should be the student's constant study. It was the observation of the human, animal, and vegetable forms, by the sculptors of Greece, which gave them that acknowledged superiority. The enrichment of these with homogeneous ornament, was no less remarkable, and deserves an especial treatise. In fact, the elements of architecture, in the orders and their profile, constitute the peculiar excellence of Greek architecture, which, as we have seen in history, did not extend to the composite and voluminous combinations which subsequent ages adopted.

Having thus adverted to individual forms as applied to detail, the Professor remarked upon general forms, as applied to the composition of buildings. The observations already offered upon the ancient system of building "in large stones and costly stones, even great stones," doubtless contributed much to the universal adoption of horizontal forms of building. But this tendency, thus imposed by the mechanical construction, seems also to have been an abstract principle of taste, which was consulted best by the contrast of the long horizontal form, with the (generally) vertical outline of the country in which they were employed. When the traveller, passing through a mountainous region of rugged outline, discovers through some gap the horizon of an extended plain, or of the ocean, a sublime sensation is experienced. In such a country the rocks and mountains afford elevations compared with which the works of man are insignificant. The temple is planted on the precipitous eminence, and it attains at once the elevation of St. Peter's or St. Paul's. So placed, the Doric members should be massive, simple, and few; the parts broad; it seems to have grown spontaneously from its rocky bed, and to partake in its monolithic masses of the stony aboriginal material on which it is established. Its horizontal outline and regularity of order are admirably calculated to contrast with the surrounding scenery of vertical and irregular forms.

On the other hand, when the road winds through interminable plains, the traveller recognizes the sublime in the contrast of vertical forms of architecture; for this reason, it may be presumed, the Babylonians in the plains of Assyria, proposed to "build a city and a *tower* whose top may reach unto the heavens." In the flats of Venice, in the Netherlands, in the champains

of France and England, especially in the low lands of Lincolnshire and the North, the spire and the tower are found to be the effective and all-sufficient means of obtaining that sublime which man desires in architecture—that conglomerate composition of small stones which a man may carry up a ladder on his back, are in character with the style and the manner of building.

But, recurring to the theory of the art, we find that Vitruvius (lib. i c 11) lays down six principles order, as addressing the understanding, disposition, as addressing the eye, proportion, symmetry, consistency, and distribution, or economy.

Order, as evincing design, whether geometrical or moral, affects the mind with the sentiment of sublime. Whoever considers the movements of the planets, and understands the laws of their velocities, the curves which they describe, the relations of the periods of their revolutions and their distances, will find himself wrapt in a sublime pleasure, and will recognize a divine beauty of order, but if he turns his contemplation to the fixed stars in which he can trace no order, and which appear to be disposed fortuitously, the same pleasure is by no means felt

When a curve is formed by a certain rule and a constant law as the semicircular vault and the apsis at the end of a church, both which shall be concentric, a great satisfaction is experienced, if these are elliptical, the rule and law is less easily understood, but much more, if eccentric segments are employed, the want of that uniformity is felt and a kind of violence is done to the eye and understanding So the rhomboid, and much more the trapezium, displease by their anomalous and unequal angles No predetermined counsel, order, or industry are evinced, and the essential sense of order is dissatisfied,

If the philosopher finds any natural production—a stone, or a root—assuming the regularity of a geometrical form, he judges it worthy of a place in his museum such is the love of order Individuals in a mob have neither force nor effect, but ranged in regimental order they acquire a new quality So trees planted in avenue have in many situations, an effect superior to the forest The desire of imparting variety to his work, often misleads the architect from this important principle of his art forgetting that his building is to derive its chief effect from the contrast of its regularity and order with the surrounding irregular objects and scenery he seeks, too often, to make his own building his picture and to engraft upon it that variety which the scenery ought to supply Thence picturesque architecture, which has diverted the student from the ancient principles, universal amongst the old masters. Succession and repetition of impression by parity of objects, by regularity and order the isometrical colonnade or Gothic arches of the nave, or equidistant windows along an unbroken front, have more energy and effect than all the varieties of such features that can be contrived The surrounding irregularities make order tell by their contrast

Vanbrugh was remarkable for this quality and he knew at the same time how, by the composition of his parts, to produce from certain points of view the utmost variety of combination and picturesqueness, while from others the whole was perfectly regular

Perrault observed order rigidly as did Wren, while by the contemporary fashionable architects amongst the Italians it was totally abandoned as may be remarked in the front of St Peter's and in the works of Bernini Borromini and Maderno Columns in groups or at irregular distances, broken entablatures for the sake of a repetition of profiles curvilinear fronts and such scenery as belongs to painting established the novelty of picturesque architecture—a solecism in art and a contradiction in terms, unless by combinations from certain points of view as above

If we call to mind the fact that the greatest architectural efforts have usually followed periods of political and moral disorder, we may recognize in such works that natural love of order, which revolutions and tumults have denied Certain it is that after a long period of civil tranquillity architectural efforts, especially of regular order, have ceased to be fashionable, and the picturesque or the irregular is resorted to as a change

Disposition or composition of the various features of an architectural work, is the second principle laid down by Vitruvius It consists says he of the idea of the ichnography the idea of the orthography or elevation, and the idea of the scenography, or view in perspective taken on the angle "These," continues he, "are the result of thought and invention, thought, full of attention, application and vigilance accompanied with *delight* and invention, which is a solution of different problems by new applications seized with *promptitude* "

Thus he proceeds as nature does putting the purpose or the plan *first*, to which the figure of the object adapts itself *secondly* and thus each composition displays peculiar features, and the appearance of his buildings would be as various as their purposes, whereas modern architects often reverse the method, and they constrain the plan to a preconceived orthography How otherwise is it that we recognize the master the moment we see his work ? The orthography ever the same, and the plan adapting itself as it can so we commonly put the cart before the horse

But the exact conception of the ultimate effect of the building, the realization of the prophetic vision of the architect, are of extreme difficulty, and subject to lamentable disappointment They can be attained only by great knowledge of perspective, and by careful models, and the greatest masters have been most remarkable for their reliance on such means

"The architect," says Wren, "ought, above all things, to be well skilled in perspective, for everything that appears well in orthography may not be good in the model, especially when there are many angles and projectures, and everything that is good in model may not be so when built, because a model is seen from other stations and distances than the eye sees the building But this will hold universally true, that whatsoever is good in perspective, and will hold so in all the principal views, whether direct or oblique, will be as good in great, if this only caution be observed, that regard be had to *the distance of the eye in the principal stations* "

In this last particular the methods of the different masters have varied materially For instance Vanbrugh always supposed himself at a distance of 500 to 1000 feet from his buildings, consequently his sky line and contour are well studied, but his details wholly neglected and the pleasing effect of his buildings in approaching them, whereas Adams supposed himself from 50 to 100 feet only from his buildings, consequently they have no contour from a distance, but are full of elaborate detail on the approach

The visual angle, extending at most to 45 should be carefully applied to the points of distance, and the scale of the drawing or study should be correctly adjusted to this distance so that no misconception should arise. A study for a building to be seen at 100 feet distance only will be of a large scale, and occupy the whole height of the paper, whereas seen at 500 feet, it may be only one fourth that size

The Greeks were consummate masters of this branch of optics as we should doubtless have known had Aristotle's work on taste been preserved to us The terms synoptic and eusynoptic correspond with the points of view which all their arrangements were calculated to afford

The Parthenon and the Temple of Jupiter Olympius—indeed almost all the great temples—were approached on the angle the peribolus and the propylea by which they were inclosed, concealing great part of them until they could be contemplated to the utmost advantage from a synoptic point of view The plans of Palmyra and Balbec and those of Rome preserved to us by Palladio are lessons in these respects demanding the most careful attention

It is obvious that street architecture being seen chiefly in flank should be treated otherwise than buildings at right angles with the point of view, as triumphal arches or terminations to the vista

In the 15th and 16th centuries perspective and its application became a new art in the hands of Lombardi, Bramante Peruzzi Raphael, and lastly the renowned Pozzo and though Vitruvius assures us that in the 5th century B.C. Agatharcus wrote a treatise upon perspective it is probable that the ancients never arrived at the skill attained by those masters

But perspective calculation applied to architecture, and the adjustment to the point of view was undoubtedly better understood practically by the ancients than ourselves as their remains abundantly prove The vista which shortens the length and discloses the end at once—the exposure of the entire object staring from a distance as well as near—the placing colossal objects in colossal places, are all modern mistakes The temple at Luxor, the colonnade at Palmyra, are deflected in angles so that the bounds are concealed the successive columns disclose themselves by degrees and the length seems interminable The temple is partially hidden, and excites the imagination from the promise of its roof entablature, and capitals until it is permitted to be seen in its overwhelming majesty

The columns of Trajan and Antonine are placed in confined positions, and the effect is tenfold

Palladio was remarkable for the adjustment of his building to the position, of which the Town Hall at Vicenza is one of the most remarkable examples and the surprise and admiration of the traveller who has known that building only in the orthographic engravings can never be forgotten

Vignola is said to have made his studies of his buildings at the points of view from which only they could be seen

It is quite certain that Sir W Chambers was less master of this part of his art than of many others Any one visiting the front of Somerset House in the Strand, is satisfied with its scale and sufficiency in all respects, but when he enters the spacious quadrangle, and looks on the back of the same building, he experiences some disappointment, he finds the scale too small for the size of the quadrangle, but much more, when he observes the same proportions from the opposite side of the river he deplores their littleness and want of mass and feature, the petty dome in the centre and the confusion of chimney shafts which disfigure the roof Had Vanbrugh disposed the river front, we should have seen those chimney shafts united in towers, the whole outline or sky-line would have been marked and varied with emphatic features suited to the scale of the river and the majestic position given to the building

It is the part of a wise man, says Alberti, to have the idea of his work well fixed in his imagination The ancients, therefore, not only by perspectives but by models of the whole, and of parts submitted their works to practised men before they laid a stone Such models should not, however, be pretty toys, in which delicacy of workmanship draws the attention from the merit of the design Finally,' continues Alberti, "when the model satisfies the architects and practised judges I recommend that there should be no hurry to begin, but if possible time should be allowed that the conceit of the design may cool, when, having laid aside the natural over weening affection for your own production, you may judge more justly of its effect Time discloses many counsels for the advantage of our undertakings, and many defects, which at first escaped attention, at length become apparent." Scamozzi used to say, that pretty little models were like pretty little birds, no one could tell whether they were masculine or femi-

nine; but if made large, you might then discern which was an eagle and which a crow.

Vitruvius, lib. vi. c. 11, and lib. iii. c. 111, refers to optical effects.

Proportion is the third principle set forth by Vitruvius, the most difficult and the most precious to the architect, and no less a golden rule in his art than in that of the arithmetician. Symmetry, which is the fourth principle of our author, is, by a vulgarism, often mistaken for proportion; but the etymology defines its meaning, as correspondence or parity of parts on either side a centre; at most it may signify proportion of aliquot parts. No part of architecture has occupied the speculations of the ingenious more than proportion, and those who have not found the analogy of the human form, as set forth by Vitruvius from the Greeks, sufficient, have endeavoured to find a more certain analogy in the laws of musical sounds: Blondel, Ouvrard and others, may be consulted on this point.

To the artist observer of the proportions and forms of animal nature, the Greek analogy seems to develop the science of proportion in the comparison of animals of the same genus, but of various species, sufficiently to show that beauty resides in inequalities; the measure of those inequalities is, indeed, not so easily defined; but the establishment of the fact may help the architect to some valuable conclusions.

Thus, if we divide the human profile, the forehead, the nose, the upper lip, and the chin, into equal parts, we have ugliness: the profile of the Apollo presents these parts in *inequalities*, and upon the nice variety of these beauty depends.

The satyrus, or baboon, is ugly, compared with the man: amongst many other reasons, for this, especially to the architect, that his proportions approach equalities. The baboon is six heads high; his arms equal the entire length of his body and legs; the subdivisions of the arm, the hand, the fore-arm, and os humeri, are nearly equal; so also the foot, the leg, and the thigh. If these proportions are compared with the human form divine, in which they are all in different and unequal lengths, the cause of beauty will be at once apparent. The human figure is eight heads high, and is inscribed by Vitruvius in a square, whereas the baboon is inscribed in a figure of less beauty, namely, a parallelogram of six by eleven, such is the length of his arms. Thus, again, if we inquire why the ass is so inferior to the horse, we shall find the same answers. The one is little more than two heads to the shoulder, while the horse is 2½; the ears of the ass approach equality with the head or neck. The scapula to the os humeri, in the ass, four to five, in the horse is four to six; the metacarpus to the radius three to five in the ass, is 2½ to five in the horse.

The Professor exhibited drawings in illustration of these remarks, and stated, that the same relations applied to vegetable nature, and that beauty there, also, would be found to reside in inequalities; and he proceeded to show, that orthographic equalities in the vertical features of architecture, both in the divisions of floors and orders, and in details, were always evidences of the decline of taste. In Greek profile it would be found universally, that the inequalities constituted their charm; in the Roman they were not so nicely observed; in the Byzantine, the plain and moulded surfaces approached equalities. So in Gothic architecture, the period of the thirteenth was far superior to any other in this respect; of which the transept of Beverley Minster, and the order of Salisbury Cathedral were beautiful illustrations. So in every other architecture, and informs of all kinds. In fact, from the long and the short, the dactyle and spondee, hexameter and pentameter, sapphics and iambics, the very term *ευρυθμια* (proportion), used by the Greeks, was derived.

Under the fifth head, Consistency, lib. i. c. 2, Vitruvius tells us, that circumstance, custom, or fitness, and nature are to guide us. Temples to Jupiter Cœlus, the sun and moon, are to be hypethral, because these divinities are known to us by their continual presence night and day. Doric temples are to be erected to Minerva, Mars, and Hercules, on account of their masculine character; Corinthian is proper to Venus, Flora, Proserpine, &c., Ionic, as the medium order, is applicable to Juno, Diana, and Bacchus; all these, says he, bear an *analogy* to the dispositions of the deities.

Again, in lib. iii. c. 1, he says, "the design of temples depends on symmetry, the rules of which architects should be most careful to observe; symmetry arises from proportion, which the Greeks call *αναλογια*." He then proceeds to describe the proportions of the human figure in detail, and remarks its correspondence with the geometrical figures, the square and the circle; even the measures used in buildings, the digit, the palm, the foot, the cubit, called by the Greeks *τελειος*, prove the analogy of architecture (continues he) with the human proportions.

In lib. iv. c. 1, Vitruvius describes the origin of the Doric, Ionic, and Corinthian orders, as derived from the proportions of the man, the matron, and the damsel, by analogy; and although these analogies have been regarded by some as fanciful, their æsthetical propriety is more intelligible to the artist, than their definition by language to the logical reader. For instance, the ancient Doric, from five to six diameters in height, though low in its proportions, assumes a dignity in its concentrated strength and solidity, its rapid diminution, and its wide-spreading cap, which no one who has viewed it at Pæstum and at Corinth can ever forget.

When Homer describes Priam as identifying the Grecian leaders from the walls of Troy, he is made to inquire of Helen—

> What's he whose arms lie scattered on the plain;
> *Broad in his breast, his shoulders larger spread,*
> Though great Atrides overtops his head?

Had Homer (always a painter) confined his description to the stoutness and the shortness of Ulysses, we should have been at a loss for his heroic dignity; he might have been a tub or an alderman, but the "broad shoulders and spreading breast" imply the rapid diminution of the waist, and the same healthful and vigorous character through every limb; and Ulysses stands before us in all the energy of the Grecian hero—

> Though some of larger stature tread the green,
> *None match his grandeur and exalted mien!*

no such peculiarity is attributed to "the great Atrides;" the tall is not compatible with this rapid diminution: whenever these qualities, therefore, are affected, as in the Parthenon, the temple of Nemea, or in the Roman Doric, the upper diameter bears a larger proportion to the lower. So in the matronal or the medium proportion, the gradation of form is much smaller; and in the juvenile Apollo or the young damsel, the diminution of the limbs is still less observable; and the Ionic or the Corinthian are proportioned accordingly. In the details the same analogy is observed; the mouth, the eye, and the features of the Hercules are as susceptible of delicacy as the Doric echinus is of its small fillets and its fine contour.

The matronal or medium demands a sober ornament, and the Corinthian all the young elegance which the acanthus and the graceful Lesbian profile can communicate.

Thus the tall, the short, and the slender, are all types of proportion in their proper places; their *excess* makes them the awkward and ungainly, the clumsy and shapeless, and the thin or meagre; and there is no other course by which they can be rightly embodied, than by the careful and intelligent observation of those types, as exhibited in the works of nature—in the animal and vegetable kingdoms.

In this respect taste, like wit, consists in discovering resemblances and unexpected congruities.

The history of the works of genius illustrates abundantly the reference to analogy in the science as well as in the art of architecture. Smeaton, in his work on the Light-House at Eddystone, after describing the former ones, and showing their defects, proceeds to explain his original conception of that celebrated work. "On this occasion," says Smeaton, "the natural figure of the waist or bole of a large spreading oak presented itself to my imagination. Its top, when full of leaves, is subject to a very great impulse from the agitation of violent winds; yet partly by its elasticity, and partly by the natural strength arising from its figure, it resists them all, even for ages. It is rare that we hear of such a tree being torn up by the roots. Let us now consider its particular figure. Connected with its roots, which lie hid below ground, it rises from the surface thereof with a large swelling base, which at the height of one diameter is generally reduced by an elegant curve, concave to the eye, to a diameter less by at least one-third, and sometimes to half, of its original base. From thence its taper diminishing more slow, its sides by degrees come into a perpendicular, and for some height form a cylinder. Now, we can hardly doubt but that every section of the tree is nearly of an equal strength in proportion to what it has to resist; and were we to lop off its principal boughs, and expose it in that state to a rapid current of water, we should find it as much capable of resisting the action of the heavier fluid, when divested of the greatest part of its clothing, as it was that of the lighter when all its spreading ornaments were exposed to the fury of the wind. And hence we may derive an idea of what the proper shape of a column of the greatest stability ought to be, to resist the action of external violence, where the quantity of matter is given whereof it is to be composed."

Sir C. Wren has given another fine example of this kind of analogy. In the vast practice which the fifty churches of this metropolis and the examination of all the authorities which he had occasion to consult had given him, he reflected that the hollow spire which he had seen or built in so many varieties was after all but an infirm structure; and he sought that model which should enable him to impart to it the utmost solidity and duration. Simple was the original from which he adopted his idea. He found that the delicate shell called turretella, though extremely long, and liable to fracture from its base to its apex, by the action of the water amidst the rocks, was rendered impregnable by the central column, or newel, round which the spiral turned. Therefore, in his spire of St. Bride's, he establishes the columella in the centre, round which he forms a spiral staircase to the top, issuing on stages of arched apertures: thus giving us (if not the most beautiful) certainly the most remarkable and enduring of any spire hitherto erected.

One more instance equally remarkable may be given. When Brunelleschi was charged with the erection of the dome of Sta. Maria, at Florence, of nearly equal diameter with that of the Pantheon, but at more than twice its height from the pavement, upon a base raised on piers, and by no means of the strength and cohesion of the original model, the Pantheon, it was apparent that in giving it the same solidity, the weight would be insupportable on such a foundation. How was this object to be accomplished? Brunelleschi was an observer of all nature's productions, and he reflected that the bones of animals, especially of birds, possessed solidity without weight, by the double crust and hollow within. But above all, he remarked that the dome which completes the architecture of the human form divine was constructed with a double plate, connected by the light and fibrous, but firm walls of the hollow cancelli, so that strength and lightness were combined in the utmost degree. Brunelleschi followed this model in his dome of Sta.

Maria (in the manner displayed in a large section exhibited); and the traveller now ascends to the lantern between the two crusts or plates forming the inner and the outer domes.

Michael Angelo adopted this contrivance in the dome of St. Peter's; and almost all the subsequent domes are upon the same idea.

The Professor pointed out these instances of analogy as sufficient to show that the architect might thus avail himself of the whole range of Nature's works; and that the universe furnished him the inexhaustible models from which his inventions might be drawn.

REVIEWS.

THE ANCIENT RUINS OF YUCATAN.

Rambles in Yucatan. By B. M. Norman. New York: 1843.

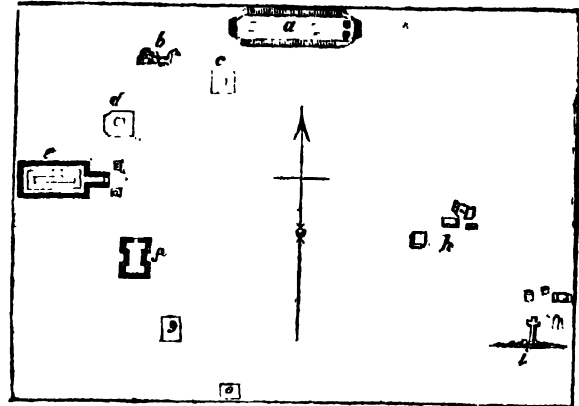
The last quarter of a century has been distinguished by the scientific and successful researches which have been made into the material and moral world of unrecorded ages. What the far-seeing predicted, but hardly hoped would occur, what the visionary exhausted himself in vain efforts to ascertain, has now taken place; the film, the mist which concealed and disfigured the unknown past, is giving way before the labours of men of science, and the long-hidden forms of antiquity's infancy are becoming revealed to our eyes: while the progress made is such that we can scarcely doubt of a glorious harvest of discovery in the end. While geology and palæozoology have shown us the rudiments of the physical world, portrayed its vegetation, and pictured the creatures which inhabited it, philology and paleætiology have thrown glorious light upon the early history of the human race. While geology was pursued on a false system, and theories were formed before facts were accumulated, its votaries were the derision of the world; nor did the philologists suffer less deservedly: their wild speculations drew from Voltaire the definition that their science was one in which "*la consonne y entrait pour fort peu de chose et la voyelle pour rien*:" and Goldsmith sarcastically determines from the resemblance of the letters, that Con-fu-ci-us and Noah were the same personages. This time, however, has now passed, and both geology and philology, studied upon the principles of Bacon, have become fixed sciences. From philology has sprung paleætiology, or the science of applying philological evidence to the history of the human races, and Bopp, Pott, Raske, Prichard, Winning, and others have successfully laboured in this department. In connection with these studies is that of the early monuments of art, the elucidations of which in Egypt, in Iranistan, in India, and America, deeply engage the attention of men of science. If in the old world we are astonished at the gigantic records of ancient civilization, we were totally unprepared to find the new continent as rich in these memorials as our own. Records of a race which seems to have "died and left no sign," works without a name, monuments bearing the impress of the fathers of civilization in India and Egypt—they are calculated to awaken the deepest interest, and to enlist the strongest sympathy of the artist and the scholar. Humboldt and Lord Kingsborough prepared the way in the study of Mexican antiquities, which Waldeck, Stephens, and Norman have followed out: and the result is, the opening a field of study in Yucatan, rich in architectural and artistical interest.

For a copy of Mr. Norman's work, we have been indebted to the kindness of Messrs. Wiley and Putnam, and we proceed to give some account of it and its author. Mr. Norman was led to Yucatan in a chance excursion in the autumn of 1841, and commenced his researches with no other instrumental aid than a knife and pocket compass, and pencil and paper; yet, although he pretends to no scholarship, he has produced a work, containing minute descriptions of the ruins, with many notes derived from the works of his predecessors. He seems to have been an active and energetic observer, and to have gone about his task with all that poco-curantism for trifles, which the wanderer in Spanish countries must possess if he would make himself happy and useful. Mr. Norman's journal contains descriptions of the manners and customs of the people, as well as accounts of the ruins, which were the more especial objects of his visit.

Yucatan, we need scarcely remind our readers, is a peninsula, remarkable for running from south to north, bounded on the east by the English settlement of Honduras, on the south by Guatimala, and on the south-west by Mexico, of which it was recently a province, although now independent. The west coast is known to us as the Campeachy shore, and was the scene of many an exploit in the logwood-cutting times of the early part of the seventeenth century. The country itself presents but little to interest us in its modern state, but in the northern parts have been discovered the ruined cities of Uxmal, Kabah, Zayi, Ticul, Sisal, Chi-Chen, and Espita; and it will be observed that not more than a third of the country has been as yet imperfectly explored, while what the mountain regions of the interior may present is unknown. The inhabitants are chiefly of Indian descent, called Mayas, of whom we shall speak again hereafter.

Leaving Mr. Norman to speak for himself, the first place to which he leads us is Chi-chen, of which a plan is shown below.

Fig. 1.—Plan of the Ruins of Chi-Chen.



a, temple; *b*, ruins; *c*, pyramid; *d*, dome; *e*, house of the Caciques; *f*, house; *g*, hacienda; *h*, evidences of large and splendid structures; *i*, cross erected by the Indians; *o*, church of the Indians.

"It was on the morning of the 10th of February that I directed my steps, for the first time, toward the ruins of the ancient city of Chi-Chen.[1] On arriving in the immediate neighbourhood, I was compelled to cut my way through an almost impermeable thicket of under-brush, interlaced and bound together with strong tendrils and vines; in which labour I was assisted by my diligent aid and companion, José, I was finally enabled to effect a passage; and, in the course of a few hours, found myself in the presence of the ruins which I sought. For five days did I wander up and down among these crumbling monuments of a city which, I hazard little in saying, must have been one of the largest the world has ever seen. I beheld before me, for a circuit of many miles in diameter, the walls of palaces and temples and pyramids, more or less dilapidated. The earth was strewed, as far as the eye could distinguish, with columns, some broken and some nearly perfect, which seemed to have been planted there by the genius of desolation which presided over this awful solitude. Amid these solemn memorials of departed generations, who have died and left no marks but these, there were no indications of animated existence save from the bats, the lizards, and the reptiles which now and then emerged from the crevices of the tottering walls and crumbling stones that were strewed upon the ground at their base. No marks of human footsteps, no signs of previous visitors, were discernible; nor is there good reason to believe that any person, whose testimony of the fact has been given to the world, had ever before broken the silence which reigns over these sacred tombs of a departed civilization. As I looked about me and indulged in these reflections, I felt awed into perfect silence. To speak then, had been profane. A revelation from heaven could not have impressed me more profoundly with the solemnity of its communication, than I was now impressed on finding myself the first, probably, of the present generation of civilized men walking the streets of this once mighty city, and amid

'Those temples, palaces, and piles stupendous,
Of which the very ruins are tremendous.'

For a long time I was so distracted with the multitude of objects which crowded upon my mind, that I could take no note of them in detail. It was not until some hours had elapsed, that my curiosity was sufficiently under control to enable me to examine them with any minuteness."

"My first study was made at the ruins of the Temple.[2] These remains consist, as will be seen by reference to the engraving (*a*, Fig. 3, & Fig. 4), of four distinct walls. I entered at an opening in the western angle, which I conceived to be the main entrance; and presumed, from

"[1] Chi-Chen signifies, mouth of a well. 'Itza,' said to be the Maya name for one of the old possessors of these ruins, is sometimes added by the natives.

"[2] The names by which I have designated these ruins, are such as were suggested to me by their peculiar construction, and the purposes for which I supposed them to have been designed.

the broken walls, ceilings, and pillars still standing, that the opposite end had been the location of the shrine or altar. The distance between these two extremes is 470 feet. The walls stand upon an elevated foundation of about 16 feet. Of the entrance, or western end, about one-half remains; the interior showing broken rooms, and ceilings not entirely defaced. The exterior is composed of large stones, beautifully hewn, and laid in fillet and moulding work. The opposite, or altar end, consists of similar walls, but has two sculptured pillars, much defaced by the falling ruins—six feet only remaining in view above them. These pillars measure about two feet in diameter. The walls are surrounded with masses of sculptured and hewn stone, broken columns, and ornaments, which had fallen from the walls themselves, and which are covered with a rank and luxuriant vegetation, and even with trees, through which I was obliged to cut my way with my Indian knife. In the rear of the pillars are the remains of a room, the back ceilings only existing; sufficient, however, to show that they were of rare workmanship.

Fig. 2.—The Temple—Chi-chen Ruins.



"The southern, or right hand wall, as you enter, is in the best state of preservation, the highest part of which, yet standing, is about 50 feet: where, also, the remains of rooms are still to be seen. The other parts, on either side, are about 26 feet high, 250 long, and 10 thick, and about 130 apart. The interior, or inner surface of these walls, is quite perfect, finely finished with smooth stone, cut uniformly in squares of about two feet. About the centre of these walls, on both sides, near the top, are placed stone rings, carved from an immense block, and inserted in the wall by a long shaft, and projecting from it about four feet. They measure about four feet in diameter, and two in thickness—the sides beautifully carved.

"The extreme ends of the side walls are about equi-distant from those of the shrine and entrance. The space intervening is filled up with stones and rubbish of walls, showing a connexion in the form of a curve. In the space formed by these walls are piles of stones, evidently being a part of them; but there were not enough of them, however, to carry out the supposition that this vast temple had ever been enclosed. At the outer base of the southern wall are the remains of a room; one side of which, with the angular ceiling, is quite perfect, measuring 14 feet long and 6 wide. The parts remaining are finished with sculptured blocks of stone of about one foot square, representing Indian figures with feather head-dresses, armed with bows and arrows, their noses ornamented with rings; carrying in one hand bows and arrows, and in the other a musical instrument similar to those that are now used by the Indians of the country. These figures were interspersed with animals resembling the crocodile. Near this room I found a square pillar, only five feet of which remained above the ruins. It was carved on all sides with Indian figures, as large as life, and apparently in warlike attitudes. Fragments of a similar kind were scattered about in the vicinity.

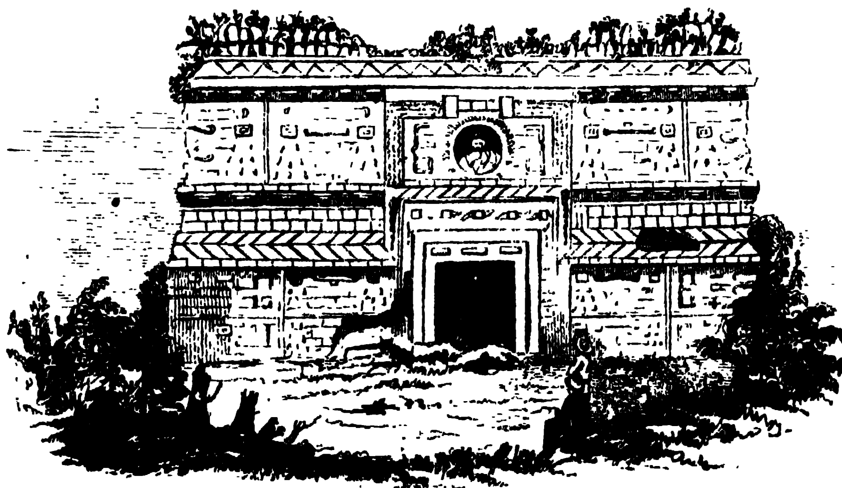
"From this room, or base, I passed round, and ascended over vast piles of the crumbling ruins, pulling myself up by the branches of trees, with which they are covered, to the top of the wall: where I found a door-way, filled up with stones and rubbish, which I removed, and, after much labour, effected an entrance into a room measuring 8 by 24 feet, the ceiling of which was of the acute-angled arch, and perfected by layers of flat stones. The walls were finely finished with square blocks of stone, which had been richly ornamented. Even yet the heads of Indians, with shields and lances, could be distinguished in the colouring.

"The square pillars of the door-way are carved with Indians, flowers, borders, and spear-heads; all of which I judged to have once been coloured. The lintel, which supported the top, is of the zuporte wood, beautifully carved, and in good preservation. One of the Indian head-dresses was composed of a cap and flowers.

"Immediately in front of the door-way is a portion of a column, to which neither cap nor base was attached. It measured about three feet in diameter, with its whole surface sculptured; but it was so obliterated by time, that the lines could not be traced. Four feet of its length only could be discovered. It was, evidently, imbedded in the ruins to a great depth. Numerous blocks of square hewn stones, and others, variously and beautifully carved, were lying in confusion near this column.

"Of the exterior of these walls, a sufficient portion still exists to show the fine and elaborate workmanship of the cornices and entablatures, though the latter are much broken and defaced. They are composed of immense blocks of stone, laid with the greatest regularity and precision, the façades of which are interspersed with flowers, borders, and animals."

Fig. 3.—The front of the House of the ues—Chi-Chen Ruins.



"I cut my way through the thick growth of small wood to the House of the Caciques, and by the aid of my compass was enabled to reach the east front of the building. Here I felled the trees that hid it, and the whole front was opened to my view, presenting the most strange and incomprehensible pile of architecture that my eyes ever beheld—elaborate, elegant, stupendous, yet belonging to no order now known to us. The front of this wonderful edifice measures 32 feet, and its height 20, extending to the main building 50 feet. Over the door-way, which favors the Egyptian style of architecture, is a heavy lintel of stone, containing two double rows of hieroglyphics, with a sculptured ornament intervening. Above these are the remains of hooks carved in stone, with raised lines of drapery running through them; which, apparently, have been broken off by the falling of the heavy finishing from the top of the building; over which, surrounded by a variety of chaste and beautifully executed borders, encircled within a wreath, is a female figure in a sitting posture, in basso-relievo, having a head-dress of feathers, cords, and tassels, and the neck ornamented. The angles of this building are tastefully curved. The

ornaments continue around the sides, which are divided into two compartments, different in their arrangement, though not in style. Attached to the angles are large projecting hooks, skilfully worked, and perfect rosettes and stars, with spears reversed, are put together with the utmost precision.

"The ornaments are composed of small square blocks of stone, cut to the depth of about one to one and a half inches, apparently with the most delicate instruments, and inserted by a shaft in the wall. The wall is made of large and uniformly square blocks of limestone, set in a mortar which appears to be as durable as the stone itself. In the ornamental borders of this building I could discover but little analogy with those known to me. The most striking were those of the cornice and entablature, *chevron* and the *cable* moulding, which are characteristic of the Norman architecture.

"The sides have three door-ways, each opening into small apartments, which are finished with smooth square blocks of stone; the floors of the same material, but have been covered with cement, which is now broken. The apartments are small, owing to the massive walls enclosing them, and the acute-angled arch, forming the ceiling. The working and laying of the stone are as perfect as they could have been under the directions of a modern architect."

Another description we take from him is that of the ruins of Zayi.

"The Ruins of Zayi are situated in the midst of a succession of beautiful hills, forming around them, on every side, an enchanting landscape.

"The principal one is composed of a single structure, an immense pile, facing the south, and standing upon a slight natural elevation. The first foundation is now so broken that its original form cannot be fully determined; but it probably was that of a parallelogram. Its front wall shows the remains of rooms and ceilings, with occasional pillars, which, no doubt, supported the corridors. The height of this wall is about 20 feet, and, as near as I was able to measure around its base, (owing to the accumulation of ruins,) it was ascertained to be 268 feet long, and 116 wide.

"In the centre of this foundation stands the main building, the western half only remaining, with a portion of the steps, outside, leading to the top. This part shows a succession of corridors, occupying the whole front, each supported by two pillars, with plain square caps and plinths, and intervening spaces, filled with rows of small ornamented pillars. In the rear of these corridors are rooms of small dimensions and angular ceilings, without any light except that which the front affords. Over these corridors, or pillars, is a fine moulding finish, its angle ornamented with a hook similar to those of Chi-Chen. Above this moulding is a finish of small plain round pillars, or standards, interspersed with squares of fine ornamental carvings; the centre of the façade showing the remains of more elaborate work, concentrated within a border, the arrangement of which is lost. There is an evident analogy existing between these ornaments and those of Kahbah, but order is less apparent. I could discover no resemblance whatever to those of Chi-Chen.

"Over these rooms of the main building is another terrace, or foundation, in the centre of which is a building in similar ruins to those under it; having, also, broken steps leading to the top. It stands upon a foundation, apparently, of six to eight feet in height, occupying about two-thirds of the area; the residue, probably, forming a promenade. There are three doorways yet remaining, the lintels and sides of which are broken, and which have caused the walls above to fall down. The walls of this part of the edifice are constructed of hewn stone, without any signs of ornament. A plain finished moulding runs through the centre; portions of the cornice still remain, with three or four pieces of flat projecting stones, which formed a part of the top finish.

"The whole extent of the rear is covered with confused piles of ruins, overgrown with trees. Near by these are fragments of walls and rooms, with a few ornaments yet remaining about them. Some of the rooms appear to have been single, and apart from all other buildings. There are also various mounds in the vicinity.

"A few rods south are the remains of a single high wall, with numerous square apertures, like pigeon-holes. Its foundation is elevated; around which the broken walls and ceilings are to be seen. The summits of the neighbouring hills are capped with gray broken walls for many miles around. I discovered no hieroglyphics or paintings of any kind; neither the extraordinary skill displayed in the ornamental carvings, as at Chi-Chen. On my route to these ruins I

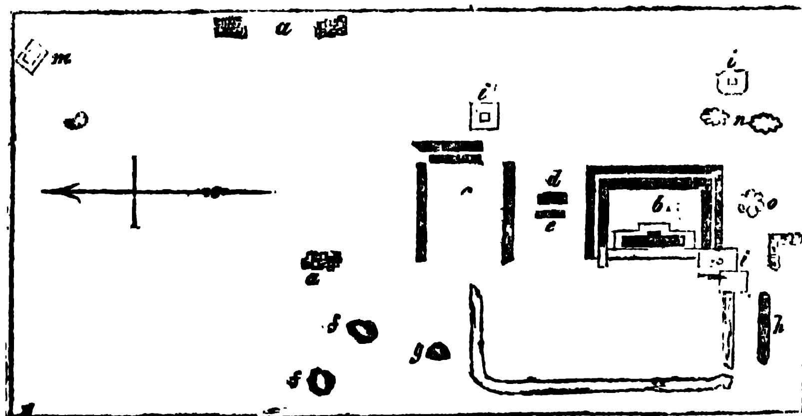
Fig. 4.—Zayi Ru



made digressions from the road, and found, on all sides, numerous remains of walls and ceilings; also, mounds and small pyramids, covered with the wild vegetation of the country."

Of Uxmal he gives a copious description, from which we extract the following.

Fig. 5.—Plan of the Ruins of Uxmal.



a a. Ruins; *b*, Governor's House; *c*, Nun's House; *d*, Snake; *e*, Ring; *f*, Pond; *g*, Reservoir; *h*, Pigeon House, *i i i*, Pyramids; *m*, Hacienda; *n*, Sepulchres; *o*, Mound

"The Governor's House is a vast and splendid pile of ruins. It stands upon three ranges of terraces; the first of which is a slight projection, forming a finish. The great platform, or terrace above it, measures upwards of 560 feet long, and 415 broad. It is encompassed by a wall of fine hewn stone 30 feet high, with angles rounded, still in good preservation. In the centre of this platform, upon which trees and vegetation grow in profusion, stands a shaft of gray limestone in an inclined position, measuring twelve feet in circumference and eight in height; bearing upon its surface no marks of form or ornament by which it might be distinguished from a natural piece. Near by is a rude carving of a tiger with two heads; also, I saw excavations near them with level curbings and smoothly finished inside, which are conjectured to have been cisterns or granaries. Along the southern edge of this platform are the remains of a range of small pillars, now broken and in confusion.

"Upon the north-west corner of this platform is an edifice, which was, no doubt, from its location, connected with the Governor's House. It is the smallest of all

the ruins. Its ornaments are few and plain; the most remarkable of which is a continuous line of turtles, cut from stone of about a foot square, arranged under the cornices.

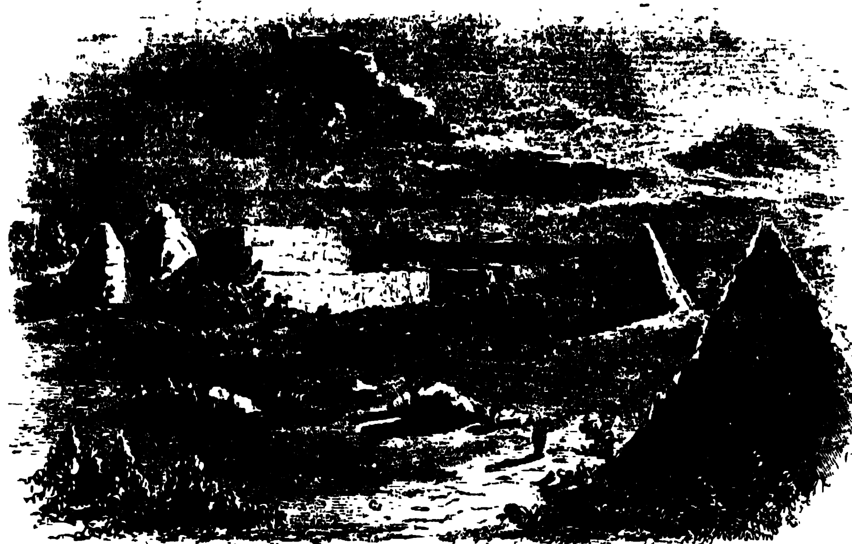
"The south-west corner has connected with it two piles of loose stones, in the pyramidical form; one 80, and the other 100 feet high, the sides of the bases measuring about 200 feet. Their tops are broad platforms, over which, and down the sides, are scattered the remains of edifices, of which these pyramids were once probably the foundations. Here we found pieces of pottery, consisting of broken pieces of vases, and supposed cooking utensils.

"Upon the main terrace stands another of smaller dimensions, constituting the foundation of the Governor's House. The measurement of this terrace is 338 feet long, 82 broad, and 30 high, having a majestic flight of stone steps, though considerably broken at the centre, in front of the entrance.

"This majestic pile faces the east, is 272 feet long, 36 broad, and 24 high. The whole building is plain (unlike those of Chi-Chen) from the base to the mouldings, which run through the centre over the doorways; above which, to the top, are ornaments and sculptured work in great profusion, and of the most rich, strange, and elaborate workmanship. It is divided into double ranges of rooms, from front to rear. Two of the principal are situated in the centre, 54 feet long, 10 broad, and about 19 high, with an angular ceiling, occupying one-half of the whole. There are 14 other rooms in the front and rear; also, two rooms on each end, and one in front and rear of the two recesses, of about one-half of the average size.

"The interior of these rooms is sometimes covered with a beautiful hard finish, and at others presents a surface of uniform square blocks of smooth stone. The floors are of stone, covered with a hard composition, which, together with the stone is now much broken.

Fig. 6.—Uxmal Ruins.—(Moon light.)



"The lintels, which are of zuporte wood, are decayed and broken, to which, in a great degree, the falling of the walls may be attributed. The inner sides of the doorways are pierced, and hooks attached, whereon doors were probably swung. There are, also, apertures in the walls, where beams rested, to support hammocks, some of which still remain, and show the marks of the cords. There were no fresco, or other painting or decorations of any kind in the interior of the building to be discerned.

"The front presents the most remarkable architectural skill to be found about the building. The walls were of the most durable kind of limestone; and upwards of three feet thick, of fine hewn stone, laid with the greatest care. There were eleven doorways besides those of the recesses. The finish of the angles, generally, was as smooth as though the material were cut with a sharp knife.

"The ornaments were composed of small square pieces of stone, shaped with infinite skill, and inserted between the mortar and stone with the greatest care and precision. About two-thirds of the ornaments are still remaining upon the façade. The most elaborate were over the centre or main entrance. These have fallen, and now are a heap of ruins at the base. One of them was a figure of a man, with a head-dress of feathers and tassels; part of which still remains, with lines of hieroglyphics underneath. The ground-work of the ornaments is chiefly composed of raised lines, running diagonally, forming diamond or lattice-work, over which are rosettes and stars; and, in bold relief, the beautiful Chinese border.

"From the centre of the building to the recess, at the northern extremity of the building, the ornaments have mostly crumbled off, and are now lying at the base in ruins; and the other parts, contiguous, seem ready to follow the example. The rear of this edifice is more plainly finished; the main part of the centre has fallen.

"Over the principal doorway are the remains of a female figure, in a sitting posture. The hands and legs have fallen. It has a fine head-dress of cap and tassels, and neck ornaments. The waist looks quite natural, and the whole was finely finished. On each side of this figure was hieroglyphical writing. The inner rooms of the centre of the Governor's House still show the places of excavations, made some years ago, by the curate of Ticul." * *

"A moonlight scene from the Governor's House is one of the most enchanting sights I ever witnessed. The moon had risen about half-way up from the horizon, and was now throwing its strong silver light over the whitened façade of *our house*. Castles, palaces, and falling pyramids were distinctly to be traced in the foreground. At a distance, walls and mounds, rising above the green verdure of the land, looked like a multitude of small islands in a calm summer's sea. All was quiet but the chirp of the cricket, or the occasional scream of some night-bird of the wood. It was a scene of natural beauty such as I never have seen realized upon canvass of the artist, or even in the pages of poetry."

Mr. Norman's work contains a sketch of the Maya language, and the latter portion is devoted to speculations on the population of America, and on the history of the remarkable antiquities to be found in different parts of the continent. The Maya language resembles the Chole, a language of Mexico, and is of very remarkable structure, the grammatical forms very much resembling the English, except that suffixes are used. A striking point is the use of auxiliaries with the verbs, a general indication of the descent of a language from one of richer forms. The assumption of what we may call the auxiliary state, is a remarkable and inexplicable philological phenomenon of which the instances are very frequent; and we may mention Anglo-Saxon and English, Hellenic-Greek and Romaic, Persian and modern Persian, Sanskrit and Bengalee. We have neither had time nor opportunity to compare the Maya language with many of the American continent, but we have with the Aymara (Peruvian) some of the Brazilian dialects, the Paraguay Guarani and Abipone and the Californian, and the result is no apparent resemblance with any of the languages but the Aymara. The Brazilian and Guarani are, as closely allied as Spanish and Portuguese, but seem to have no points of resemblance with the others, and use affixes instead of suffixes. The Aymara, it is to be observed, is one very extensively spread in Peru, and is spoken by the Canchis, Castas, Collas, Collaguas, Lupacas, Pacases, Carancas, Charcas, and others, being the native language of the Lupacas. This language has been a good deal cultivated by the missionaries, as the Maya has been, and a grammar of Aymara was published at Rome as early as 1603, the first Maya grammar appearing in 1560. The following words seem to show a resemblance between the two languages.

	Maya.	*Aymara.*
Father	hachyum	Auquihana
Mother	hachnaa	tayca
Man	uinic	haquenaca

In construction there is also a considerable resemblance, the pronouns being suffixed to the other words. The following is an example of pronouns in the two languages.

	Maya.	*Aymara.*
My	in	na, ana, nahasa
Ours	ca	cha, cass
His	u	ru
Theirs	an	ana

The general resemblance between the Aymara and the Maya appears in actual observation to be as close as that of two families of the Indo-European languages, but does not extend to general words, only to some of the simple words, and to construction.

Into Mr. Norman's speculations we cannot enter, but we cannot resist observing that the general evidence seems to bear upon the common origin of the civilized races of America, and their relationship to the civilized races of the old world. When we trace the Indo-European languages up to their common stock, we find in the Sanskrit, Zend and Persian types, although many points of resemblance, many points of diversity, and perhaps no greater difference exists between the Japhetic, Semitic, and Hamitic languages, or whatever the classification may ultimately be determined to be. It certainly is the case that although there is a distinct character of the Semitic [1] and Indo-European languages, that points of identity are to be discovered, while among the scattered people of the Pacific ocean, many relics of language are to be found, which may have a relationship with those two great divisions. [2] There is nothing, therefore, to countenance any departure in that respect from the testimony of the sacred records as to the common origin of the several human races. Supposing the American civilized races to have migrated from Iranistan, their route might lay through southern Siberia (in which ancient and extensive monuments are to be found), across the Pacific to the Columbia, by the course of that river to the valley of the Mississipi, thence through Mexico, to the western coast of South America. The circumstance of a race not occupying the whole of a country, is frequently to be found in the migrations of the Indo-European nations. Thus it is questionable if Scandinavia and Ireland were ever occupied by what Mr. Winning calls the Perso-European races, who pushed out the Medo-European races. A subsequent Mongol invasion of the American continent, taking a different route, might have supplanted the civilized population, and extended its settlements in the same way that is familiar to us in the history of Europe. But we must leave such speculations, and wait for the researches and labours of others to reveal that fossil history of America, which will yet be digged from its monuments, and collected from among the tribes of its children, secluded in mountain fastnesses.

Martin Chuzzlewit. By Boz. London: 1843.

It must be confessed that we seem to go altogether out of our way in bestowing any notice on a work of this kind; still, as Mr. Dickens treats the architectural profession rather cavalierly in this new production of his, we feel ourselves called upon to be equally free with him, and must tell him, that, as far as they have yet been shown, both his Mr. Pecksniff and his Tom Pinch are errant caricatures—not only over-drawn, but ill-drawn—fantastic creatures of one who seems to mistake sheer extravagance for imagination. It now looks as if Mr. Dickens had been quite spoilt by success, and accordingly fancies that whatever he writes will be sure to take with the public. So far, he may not be very much in the wrong, for we believe that had "Chuzzlewit" been given to the world without his name, it would have been pronounced "sad stuff." What should be character is only coarse caricature, and is laid on, not with the pencil of a master, but with a *trowel*. Mr. Pecksniff might do for a "Gin-Palace" architect, but for nothing better; and even then his barefaced hypocrisy, as blundering too, as it is barefaced, is perfectly gratuitous, and by no means a professional trait. We may therefore suppose, that such as it is, that character is intended as an individual portrait, the original of which we are quite unacquainted with. At all events, it is a highly disagreeable and absurd one; and wholly destitute of probability. It might be rendered a vehicle for wholesome satire, but not, we fear, by Mr. Dickens, for to say the truth, he appears to know very little either of architecture, or the profession. In fact, he evidently *shirks* the former, otherwise he would have shown up the absurdities of Mr. Pecksniff's own designs, and would have let the public see what arrant humbug and quackery will impose upon it. Humbug, however, is by no means confined to the architectural profession: at the present day there is more than enough of it, on the part of those *critics*, who would fain persuade us that we have got another Henry Fielding in Charles Dickens; which we shall believe when we believe that Tom Moncrieff is a second William Shakspere.—After all, we may be mistaken in one very essential point,—namely, the authorship of the work: inasmuch as it professes not to be written, but merely *edited*, by Boz. Consequently he does not give it to the world as his own, and has probably merely been employed to lick into shape some other person's literary cub.

[1] We may note that we have observed great resemblance between the affixes and suffixes of the Hebrew and Arabic and the Magyar, and in the pronouns generally.

[2] It is curious to observe the wide spread of the roots mira (Sanscrit), sea or water, and ship or skiff,—words perhaps which boast of the most extensive diffusion; and admitting the seat of the human race to be in Iranistan, easily to be accounted for by the neighbourhood of the Euphrates and the Indus, the Persian Gulph, the Arabian and Caspian seas.

Ancient and Modern Architecture. By M. Jules Gailhabaud. London: Firmin Didot, 1842. Parts 4, 5, 6, and 7.

The interest of this work continues unabated. We find in the numbers before us, the Tower of the Giants at Gozo, Temple of Segesta, St. Vital at Ravenna, the Cathedral of Freyburg, the Certosa at Paira, the Mosques of Cordova, and Ebu Touloun at Cairo, and a Gallery in the Church of the Madeleine at Troyes. The two plates of St. Vital and its details give as good an idea of that remarkable monument as could be desired, and also another remarkable monument of very remote antiquity, the Tower of the Giants, is extensively illustrated. The designs seem, indeed, to be executed with that care which is requisite to give them value, as a work of reference.

The Topographer and Genealogist. Part I. London: J. B. Nichols.

This is a quarterly work, which takes up a good position in a field where much service is to be done. In the first article on the Earls of Lincoln, we recognize a spirit of critical research, which promises to do much good in the weed-abounding field of genealogy; but we should have liked also a more comprehensive grasp of the historical bearings of the subject. The *catalogues raisonnés* of brasses, monuments, and new antiquarian publications, will prove invaluable to the amateur and student, and makes stores of information readily available, which now require unnecessary labour to reach. If this work can but keep pace with the mass of scattered information constantly springing up on the subjects of its research, and present regular digests of them, as digests of cases are supplied to the legal profession, antiquarian and topographical studies will be very much advanced. We may notice a slight clerical error, by some mistake. Mr. Akerman's valuable Glossary of the Wiltshire Dialect has crept under the head of works relating to Yorkshire.

Examples of Encaustic Tiles. Part III. London: J. B. Nichols.

This number contains some examples of heraldic tiles, which perfectly show the applicability of this material for such kind of decoration. It also illustrates a series of wall tiles from Malvern, and the curious tile from Worcestershire, bearing the following inscription here slightly modernized.

"Think, man, thy life may not aye endure—
That thou dost thyself, of that thou art sure,
But that thou keepest, unto thy *factor's* cure.[1]
And ever it avail thee, it is but adventure.[2]

Mr. Nash reads *executor*, but we should suggest *factor* or *faicteur*, an agent, by which the applicability of the text is equally maintained, and its language better preserved.

BADEN-BADEN.

The new *Trinkhalle*, or Pump-room, by the architect Hubsch, at Baden, is spoken of in terms of very high commendation by a writer in a German periodical. "I consider this building," he says, "to be one of the happiest specimens of architecture that have been produced in our times. Delightfully situated, the structure itself is beautiful in its form and proportions, and unaffectedly expressive in character,—significant in design, and preserving a tasteful medium between unmeaning decoration on the one hand, and bare and dry scantiness of it on the other." The building is raised on a boldly rusticated substructure, and consists of seventeen open arcades, whose flattened arches spring from columns, which last are not according to any particular order, except that their capitals, being foliaged, partake of the Corinthian character; but the columns themselves are of

[1] Care. [2] Chance.

shorter proportions, and the angles of the abacus are cut off so much as to render that member octagonal. The centre consists of five arches, resting on two antæ and four columns, with steps leading up to it, and is crowned by a pediment with a bas-relief by Reich, a young sculptor now rising into celebrity. The merits of the design must, however, be taken entirely upon trust, for there is very little amounting to description in what Ernst Förster says of it. Some particulars that might easily have been stated are passed over altogether, notwithstanding that, for want of them, it is impossible to form any distinct idea of the structure. There is, for instance, not a single dimension given by which we might even guess at its size: nor is it even so much as said whether it is an edifice of any magnitude. We are again quite at a loss to understand whether the "seventeen arches" spoken of belong only to the principal elevation, or not. The "description," in short, is of that kind which, though it may be clear enough to those who have seen either the building itself, or drawings of it, is unintelligible without such additional information,—a very common, but also a particularly provoking, fault.

DREDGING AND DREDGING MACHINES.

[The following communication describes a practice called *radius cutting*, which has been recently introduced into several large dredging operations. In this new process a lateral sweep, or circular motion, is given to the ladder, or bucket frame, which swings upon its upper extremity as a centre, and in its action imitates that of a scythe in mowing,—with this difference, that the scythe only cuts from right to left, whereas the buckets cut both backwards and forwards, which is the meaning of our correspondent when he says the machine cuts in both traverses. According to the old system of working, which our correspondent styles *trench cutting*, the bucket frame has only a vertical motion, the effect of raising or lowering its inferior extremity by means of ropes and sheaves fixed at the bows of the vessel. The machine could only cut right forward in straight lines, and had to be hove up to its work or dropped down from it when the buckets had done their work in the axis of the frame. Our correspondent contends that the zigzag motion from one cutting position—that is, from one trench to the other—is inconvenient, and occasions a loss of power: that the buckets cutting in trenches are very liable to cut in holes where the bottom is already sufficiently deep: and that after the dredging has been executed in parallel lines, there are still ridges left between the trenches which must be worked off by a repetition of the process. At present we are not able to see clearly how the two latter of these objections are obviated by the new system of radius cutting. However, we insert the letter of our correspondent in full, and shall be happy to receive further information as to the working of this system.—Ed.]

Sir—Having twice had to make out plans and specifications of new dredging machines for works where I have been an assistant, I have bestowed a good deal of attention on this subject; and recent accidents to masonry where modes of cutting other than dredging have been adopted, have induced me to send you the following remarks on the new system of "Radius cutting," which has been found so successful on one of the largest navigation improvements at present going on.

In the ordinary method of "trench" cutting, the power applied to lead the machine ahead into the cutting, has also to resist the reaction of the buckets: so that in the Dublin machines it was thought worth while to take the power from the engine. In the Clyde boats this process requires a great expense of manual labour, but Mr. Bald has taken the power from the engine in the newest machine[1] (No. 5).

Now, in radius cutting, the chain from the bow of the machine is not wound up while it is cutting, but is only shortened at each return of the machine, which may be described as swinging on that chain just like the "bob" on a pendulum: the machine being led laterally to the cutting by the *side chains*. These side chains are comparatively easy to work, as the reaction of the buckets is mostly against the radius chain.

There is no more difficulty attending the use of these lateral chains in a harbour, or narrow navigation, than in "trench" cutting, where corresponding chains, or "guys," are required to keep the machine in line, and these are necessarily used on both sides at once; whereas these lateral chains are only tightened on one side,—namely, that on which the machine may happen to be traversing; and where it is required to lower them, to allow vessels to pass, they have only to be tightened up till the buckets fill again.

In the old system of working the boat *ahead*, it has to stop when it has cut a trench, come back over the same ground, and be set again to commence cutting another trench; and after the requisite breadth is traversed, the machine must again work over the same breadth, in the same zigzag manner, to cut the "ridges" which were left between the "trenches." This is the most clumsy and unprofitable part of the system, as these ridges yield before the buckets when soft, and stand when hard, causing a continual raising and lowering of the "ladder." Any engineer may satisfy himself of this, by standing to see the soundings at the "well," which are so irregular that half the full work is not performed: and there is no doubt of the immense loss, by the machine cutting in what is termed "holes."

All these evils are greatly reduced by working with a radius chain. The machine cuts in both traverses, and carries the work clean before it. The surface of the bank can be pared to any level, the machine passing over the hollows and cutting only the heights, and so never wasting time by dredging in holes.

There is no loss from taking the machine rapidly over the ground, when such might be required to keep the buckets full; but in the old system there would be a great loss in doing so, and paring only to a certain extent at each run,—for the backing of the machine is a dead loss of time. Yet though this loss is obvious, there might be a greater, from endeavouring to reduce it by keeping the buckets full the whole length of the trench, for then they might get into holes; and if a machine continue to lift quick stuff from a hole which may happen to be near a hard part of the bank, it can do little good, as the hole, if very quick, fills up of itself, or may soon be expected to collect alluvial matter.

Although it may be true, that, to cut or trench a bank in the proper current, will, by changing the currents and eddies, remove it by a natural process; yet, as this is a point so difficult to hit upon, it is generally allowed, that, to get large stones and rocks taken up, and to cut the surface fair, is the surest way of reducing a bank, and of leaving it in the condition least liable to "silt up."

It is with these views of the advantages to be derived from the judicious application of machines, that the preceding mode is brought under the consideration of your readers.

There have been great improvements made in the machinery by the practical engineer; but the civil engineer has not made any corresponding advancement in the working of the machine, although it is his right hand instrument. By attention to the working of the machine, much time and expense may be saved, which no improvement in mere construction of the machinery could ever effect. Dredging machines seem just to be put into the hands of their captains and engine-keepers, to make the best of them. And it cannot be doubted that the performance of these machines might be greatly increased by improved application; indeed, the improvements here described go far to prove this, as they effect a saving of at least one-fourth of the power. When men of science bestow due attention on the subject, farther advancement may yet be made, and the dredging machine be found not only by far the most safe and expeditious, but also the cheapest mode of cutting.

The difference of construction in the machine for working on the radius principle is very little, and need only be made at the lower end of the bucket ladder. As the machine is led side-ways to the stuff, the lower "tumbler" has no flanges, as in the ordinary tumbler, on which they are necessary to assist in keeping the buckets from swerving as they are pressed forward; but instead of the flanges there are "snugs" on the tumbler between the chains to keep them on. It would be useless to notice other parts of the construction in this paper, as that is the characteristic difference. The four crab winches usually erected on the deck of a machine serve with a snatch-block to wind the traverse chains.

30, Hope Street, Glasgow,
21st March, 1843.

W. C., C.E.

[1] No dredging machine is complete unless the work of heaving the vessel ahead be performed by the engine. It is one of the most obvious applications of the steam power by which the machine is worked, and we believe some of the earliest engines—for instance, those on the Caledonian Canal—were so contrived, as to be hove forward by the engine when required.—Ed.

Bell Rock Lighthouse.—The monthly return from this establishment for February takes notice of a heavy sea upon the rock, from the north-east, on the 14th and three following days, when the spray rose from 70 to 80 feet on the lighthouse tower. On each of these days, says the return, "we felt the building tremble but very little." Various of the travellers or boulder stones upon the rock have been shifted from "Arniston and Ulbster" ledges to the west end of "Hope's" Wharf. The boulders connected with the "Royal Burghs" have also been tossed about; one of these measures nine feet in length.—*Caledonian Mercury*.

ABERYSTWYTH HARBOUR.

Sir—In perusing "Blackford and Imray's Charts and Sailing Directions for St. George's Channel, 2nd ed." lately published, at p. 40 I find an account of this harbour as follows:—"Aberystwyth Harbour is a narrow creek, and not fit for vessels that draw above 9 or 10 feet water, and these must have spring tides to go over the bar." From the following account it will be seen what alterations have taken place through engineering skill, which has completely set aside the above description.

The Harbour of Aberystwyth is situated in the bottom of the Bay of Cardigan, terminated by Bardsey Island on the North, and Strumble Head on the South, and lies about 5 leagues E.N.E. from New Quay, but more immediately between two points of land, the Castle Hill on the North, and Alltwen on the South. Between these two points of land, the Rivers Rhydiol and Ystwyth empty themselves into the sea. Aberystwyth Harbour may be distinguished at some leagues distance by Pen Dinas Hill, which rises steep on the south end, also by the ruinous castle near the town.

The sea coast here about is nearly N.N.E. and S.S.W. by compass bearings; the prevalent winds from the W., and more especially from the W.S.W. produce the heaviest swells; for in that direction the Aberystwyth coast lies exposed to the fury of the Western Ocean.

The Harbour, in its original state, was probably only the mouth of a mountain river, the Rhydiol, which, after a course of about 20 miles through a slate stone soil, falls into the sea. The Rhydiol, like other mountain streams, is subject to sudden and violent floods, or freshes, during rainy seasons, and a great quantity of slate, gravel, and other matter is brought down the river by the effect of these freshes. The foregoing observations equally apply to the River Ystwyth. The Ystwyth having united its waters with the Rhydiol at the entrance of the Harbour, these two rivers maintain one common outfall, through the beach into the sea. The slate gravel brought down the rivers, and the beach that was brought from the southward, accumulated, and being thrown up by the action of the sea, a *bank* or *bar* was formed at low water. This bar offered a constant obstruction to vessels, in their ingress and egress, and often caused great destruction of life and property.

Now to show what engineering has done. In the year 1838, the trustees commenced a substantial new stone pier on the south side of the entrance of the harbour, to protect the harbour from the western gales, and to prevent the beach from accumulating and forming a bar. This pier is now (1843) extended from the beach 260 yards in the direction of SSE and NNW, and as far as is completed, has fully answered their expectation. In the first place, it has stopped the progress of the beach, and deposited the same at the back of the pier. Secondly, it has guided the rivers into a proper channel, by which it has caused a deeper channel to be formed, and removed the bar. Thirdly, instead of 9 or 10 feet water at spring tides, it has now obtained that height or more at the neap tides, and an average of 16 feet at spring tides. Lastly, it has removed that danger to vessels and mariners arriving or sailing or having to wait in the bay during the neap tides, for water to enter the harbour. The portion of the river Rhydiol and the harbour at high water, occupy an area of about 20 acres. On the pier is erected a powerful capstan, supplied with ropes, and a store house; and about 400 yards to seaward off the end of the pier, are moored two large transporting buoys, lying in 4½ fathoms low water spring tides, for vessels to moor to or warp from, and every facility is rendered vessels making or leaving this port, by signals and lights at tide times; it is now considered by all mariners that visit this port to be the best tidal harbour in the principality, when, but a few years since, it was the worst.

Vessels visiting this port can be supplied with every accommodation for repairing, &c., there being two ship-building departments, a rope walk, and sail makers, also bar and block warehouses. The markets are well supplied, and sufficient stores can be obtained.

An Old Subscriber.

Aberystwyth, March 1st, 1843.

STEAM POWER.

Sir—The detailed table of the values of the different degrees of expansion in the engines of the *Great Britain*, which appeared in the March number of this *Journal*, afforded me much pleasure, since they will tend to produce a conviction of the advantages in the minds of owners of steam boats, who might disregard the form in which it has been already advocated in your pages.

In consequence of an inadvertent change of my expressions from "a cubic foot of water *expended as steam*, is equivalent to one horse power per hour," to "the evaporation of a cubic foot of water is equal to one horse power," you appear to have overlooked the limits I intended to apply to the assertion. The words in italics, which had been used in a few lines above as "*expended as steam in the cylinder*," were inserted to exclude the power due to expansive action, as well as the waste, 1st, in blowing off, 2nd, at the safety valve, 3rd, clearance steam, and 4th, cooling. I happened to roughly estimate these losses at 1 lb. of water for an expenditure of 7 lb. of water as "dense steam" doing work in the cylinder, while the communication with the boiler remained open, making the boiler evaporation identical with your assumption; and I feel assured you will grant me permission to refer to this charge of inaccuracy, and to the standard of horse power assumed in my remarks on nominal horse power in the *Nautical Magazine*.

I merely followed Tredgold in the assumption that steam of atmospheric strength will produce 3,600,000 lb. pressure one foot high, and consequently maintain during one hour, a gross power on the piston of 60,000 lb. one foot high; and I apprehend this assertion is equally true, with a slight increase for higher steam, and a slight decrease for steam below the atmosphere for the "*dense steam*" not worked expansively.

As a secondary assertion I added "this gross power is capable of producing 33,000 lb. on the connecting rod," and perhaps in the best engines from 40 to 50 per cent. more, still it is not competent to produce an excess of 75 per cent., and much less an excess of cent. per cent. as due to 14 lb. net pressure, which amounts to 66,000 lb. per minute.

This standard of 60,000 lb. gross pressure I had understood has been occasionally used, or been recommended to be used, by civil engineers in contracts, to prevent disputes with engine makers respecting the excess of power above nominal horse power to be supplied, and it seems a fair mean. Moreover, it meets the difficulties arising from higher steam, and the reduction of power due to expansion, and it is equally applicable to non-condensing engines (the estimate of horse power of these engines seems somewhat undefined).

The employment of an indicator, the value of which you have adverted to, is obviously required in estimates of the above nature; and though well adapted as a standard of comparative power and coal consumption, yet nominal horse-power might still be used as a measure of the size of the engine, which seems a good commercial unit, of the same value as the diameter in inches, of the cylinder used in Cornwall, where the loads vary from 5 lb. to 16 lb. per square inch, and the strokes from 2 to 11 per minute in large engines.

Accustomed to refer to the "work performed" or duty, I concur entirely in the appeal to the "work to be done" by the engines of the *Great Britain*, especially as I anticipate the most favourable results from the mode in which the designers of the *Great Britain* have availed themselves of the condition that their capacities increase in a faster ratio than the areas of the midship sections of vessels.

I have the honour to remain, Sir,

March 10th. Your's, obediently,

John S. Enys.

INSTITUTION OF CIVIL ENGINEERS.

Jan. 10.—The President in the Chair.

The business of the meeting was commenced by reading an abstract of Mr. Davison's paper (No. 539) describing the mode adopted for sinking a well at Messrs. Truman, Hanbury, Buxton, and Co.'s Brewery, which was published in the minutes of proceedings of session 1842, p. 192, and the following observations were made.

Mr. Braithwaite described the difference between the method employed in sinking the well for Messrs. Truman and Co., and that for Messrs. Reid and Co. In the former the bore was small, and would therefore only produce as much water as was procured from the veins through which it passed vertically, while the latter, by its larger diameter, permitted lateral galleries to be driven in the direction of the fissures in the chalk: thus forming feeders for the well, and at the same time capacious reservoirs wherein the water accumulated when the pumps were not at work.

He attributed the comparative failure at Messrs. Truman's to errors in the mode of sinking. the length of the cylinders which had been attempted to be forced down was too great, and the lateral pressure had prevented them from reaching the chalk, so that when the pumps were set to work an undue quantity of sand was drawn up with the water, causing a cavity behind the brick-work, which at length fell in. The water having been pumped out to a lower level than was proper, the equilibrium between the water and the sand around the cylinder had been disturbed, and the "blow" of sand had ensued.

The New River Company had been advised to sink a well of sufficient

diameter to enable them to excavate lateral galleries, but they had sunk their well in the Hampstead Road, of a small diameter, as described in the paper by Mr. R. W. Mylne, published in the third volume of the transactions of the Institution;[1] and although fissures had fortunately been traversed, which gave an ample supply of water, many of the difficulties encountered would, he contended, have been avoided by adopting the larger diameter, and sinking the cylinders into the chalk, before the pumping was commenced.

The supply of water at Messrs. Reid's well had been sensibly affected by the recent proceedings at the Hampstead Road well, which was now being constantly pumped in order to sink it deeper.

Mr. Davison explained that a bore of small diameter had been adopted, because it was calculated that a supply of water, sufficient for the wants of the brewery, would have been obtained by it. The excavation to within five feet of the chalk was suggested by the sudden dropping of the cylinder. He believed that when (contrary to his express instructions) the level of the water was reduced by pumping to below a given point, the sand from beneath the oyster-bed rushed in to restore the equilibrium within the cylinder, and thus caused the difficulties which he had to contend with.

During the last year the pumps had been at work 1616 hours, in which time 300,000 barrels, or 50,000 tons, of water had been drawn from the well.

Mr. Farey believed that the casualties in well sinking, generally arose from the sources which had been mentioned. Mr. Woolf encountered them when sinking the well at Messrs. Meux' (now Messrs. Reid's) brewery. The pumping up of sand with the water was there carried to such an extent as to cause an accumulation of sediment two feet deep in the liquor back, in 14 days, and ultimately the new well broke into the old one adjoining it.

Mr. Braithwaite explained, that, in the year 1814, the well at Messrs. Meux was pumped "to clear the spring," which caused a cavity of nearly 40 feet deep from the sides of the well, and endangered the stability of the buildings around. Piles were therefore driven to support the upper ground, and upon them the brick steining was carried up. If the cylinders had in the first instance been carried down to the chalk, before the pumping had commenced, this accident would not have occurred.

Mr. Vignoles remarked that the same question, as to the relative merits of boring or sinking, had been discussed at Liverpool, for wells in the red sandstone, and in practice it had universally been found that, by the latter system, the best supply of water had been procured, particularly when side drifts had been made.

Mr. Mylne said that the works at the well in the Hampstead Road, which had been repeatedly stopped from accident, were now resumed as an experiment; the quantity of water obtained was more than could be drawn by a pump 12 inches diameter, 6 feet stroke, making 10 strokes per minute (= 294 gallons per minute). The spring was struck at about 234 feet below the surface of the ground, and when the engine was regularly at work, the water generally stood at within 20 feet from the bottom of the well. He coincided in the opinion of the advantage of a well of large diameter over one of small bore, as it permitted side excavations to be made in search of water. This plan had been pursued with success at Brighton.

Mr. Taylor observed that another of the advantages of the large diameter was, that the proceedings could be watched, and accidents could be more readily remedied; the opinion of all practical miners was, that the large diameter was cheaper, as well as better, than the small bore.

Mr. Clark promised an account and drawings of a well now sinking by him at the Royal Mint. The advantages of a large diameter were manifest to all practical men, particularly when the augur or "miser" was used, as it enabled the operation to be continued without pumping; the cylinder, in lengths of not more than 30 feet each, followed the "miser" down regularly, and as soon as they reached the chalk, the operation was considered safe; and as the "miser" did not excavate more than was due to the area of the cylinder, the equilibrium between the water within and the sand without the cylinder was never disturbed. In a well sunk by him at Messrs. Watney's distillery, the cylinders were 11 feet diameter; the "miser" used was 5 feet diameter, and was turned by twelve men at a time.

Mr. Braithwaite concurred in the advantages of using the "miser;" he invariably employed it, and generally with success.

Mr. Farey believed that the augur or "miser" was first used in this country by the late Mr. Vulliamy,[2] of Pall Mall, for sinking an Artesian well, into which there was an irruption or blow of sand, the effect of which was only overcome by this instrument.

"*An Experimental Inquiry as to the Co-efficient of Labouring Force in Overshot Water-wheels, whose diameter is equal to, or exceeds, the total descent due to the fall; and of Water-wheels moving in circular Channels.*" By Robert Mallett, M. Inst. C. E.

This paper is partly mathematical, and partly experimental. The investigation which it details, the results of which are given in ten tables of experiments, had in view principally to obtain the definite solution of the following questions.

1st. With a given height of fall and head of water, or in other words, a given descent and depth of water in the pentrough, will any diameter of wheel greater than that of the fall give an increase of labouring force (*i. e.* a better effect than the latter), or will a loss of labouring force result by so increasing the diameter?

2nd. When the head of water is necessarily variable, under what conditions will an advantage be obtained by the use of the larger wheel, and what will be the maximum advantage?

3rd. Is any increase of labouring force obtained, by causing the loaded arc of an overshot wheel to revolve in a closely fitting circular race, or conduit? and if so, what is the amount of advantage, and what the conditions for maximum effect?

The author briefly touches upon the accepted theory of water wheels, the experimental researches of Smeaton, and the recent improvements in theory, due to the analytic investigations of German and French engineers.

Smeaton, in his paper on water wheels, read to the Royal Society in May, 1759, and Dr. Robison, in his treatise on water wheels, lay down as a fixed principle, that no advantage can be obtained by making the diameter of an overshot wheel greater than that of the total descent, minus so much as is requisite to give the water, on reaching the wheel, its proper velocity.

The author, however, contends that while the reasoning of the latter is inconclusive, there are some circumstances which are necessarily in favour of the larger wheel, and that conditions may occur in practice, in which it is desirable to use the larger wheel, even at some sacrifice of power; and that hence it is important to ascertain its co-efficient of labouring force, as compared with that of the size assigned by Smeaton for maximum effect.

The author states, first, the general proposition, "that the labouring force ("travail" of French writers), or "mechanical power" of Smeaton, of any machine for transferring the motive power of water "is equal to that of the whole moving power employed—minus the half of the *vis viva* lost by the water on entering the machine, and minus the half of the *vis viva* due to the velocity of the water on quitting it." He deduces from the theory, the following results, coinciding with the conclusions obtained by experiment.

1st. If the portion of the total descent passed through by the water before it reaches the wheel be given, the velocity of the circumference should be one-half that due to this height.

2nd. If the velocity of the circumference be given, the water must descend through such a fraction of the whole fall before reaching the wheel, as will generate the above velocity.

3rd. The maximum of labouring force is greater, as the velocity of the wheel is less; and its limit theoretically approaches that due to the whole fall.

General equations are given, expressing the amount of labouring force in all the conditions considered, and their maxima.

One of the principal advantages of using an overshot wheel greater in diameter than the height of the fall, is the power thus afforded, of rendering available any additional head of water occurring at intervals, from freshes or other causes, by admitting the water upon the wheel at higher levels.

The first course of experiments is dedicated to the determination of the comparative value of two water wheels, one of whose diameter is equal to the whole fall, and the other to the head and fall, or to the total descent; by the head, being in every case understood, the efficient head, or that due to the real velocity of efflux at the shuttle, as determined according to Smeaton's mode of experimenting.

The apparatus employed in this research consisted of two accurately made models of overshot wheels, with curved buckets. These were made of tin plate, the arms being of brass, and the axles of cast iron. Special contrivances were adopted to measure the weight of water which passed through either wheel during each experiment, to preserve the head of water strictly constant, and to determine the number of revolutions, and the speed of the wheels.

One wheel was 25·5 inches diameter, the other, 33 inches diameter. The value of the labouring force was determined directly, by the elevation of known weights to a height, by a silken cord over a pulley; the altitude being read off on a fixed rule placed vertically against a lofty chimney; and in other experiments, relatively by the speed of rotation given to a regulating fly or vane. The depth of the efficient head was 6 inches in all cases.

The weight of water passed through either wheel in one experiment, was always 1000 pounds avoirdupoise.

All the principal results given in the tables accompanying the paper, are the average of five good experiments; from the large scale upon which these were conducted, the accurate construction of the apparatus, and the care bestowed upon the research, which was undertaken with reference to an actual case in the author's professional practice, he is disposed to give much confidence to the results.

The weight of water contained in the loaded arc of each wheel is accurately ascertained, and in the tables which accompany the paper, the results of the several experiments are given at length.

The velocity of the wheels, under different circumstances, is carefully noted and discussed with respect to the maximum force.

The author next ascertains the value of the circular conduits, and states that generally, in round numbers, there is an economy of labouring force, amounting to from 8 to 11 per cent. of the power of the fall, obtained by the use of a conduit to retain the water in the lower part of the buckets of

[1] Trans. Inst. C. E., vol. iii. p. 229.

[2] Vide *Nicholson's Journal of Philosophy*, vol. ii. p. 266.—"An Account of the means employed to obtain an Overflowing Well at Norland House in 1794," by Benjamin Vulliamy.

an overshot wheel, whose diameter is equal to the fall. The velocity of a water wheel working thus, may vary through a larger range without a material loss of power, and a steady motion is continued to a lower velocity than when it is working in a free race.

The author finally arrives at the following general practical conclusions:—

1st. When the depth of water in the reservoir is invariable, the diameter of the water-wheel should never be greater than the entire height of the fall, less, so much of it as may be requisite to give the water a proper velocity on entering the buckets.

2nd. When the depth of water in the reservoir varies considerably and unavoidably in depth, an advantage may be obtained by applying a larger wheel, dependent upon the extent of fluctuation and ratio in time, that the water is at its highest and lowest levels during a given prolonged period; if this be a ratio of equality in time, there will be no advantage; and hence, in practice, the cases will be rare when any advantage will obtain by the use of an overshot wheel, greater in diameter than the height of fall—minus, the head due to the required velocity of the water reaching the wheel.

3rd. If the level of the water in the reservoir never fall below the mean depth of the reservoir, when at the highest and lowest, and the average depth be between an eighth and a tenth of the height of the fall, then the average labouring force of the large wheel will be greater than that of the small one; and it will of course retain its increased advantage at periods of increased depth of the reservoir.

Dr. Robison's views, therefore, upon this branch of the subject, should, he contends, receive a limitation.

A positive advantage is obtained by the use of the conduit varying with the conditions of the wheel and fall, of nearly 11 per cent. of the total power.

The value increases with the wheel's velocity up to 4½ feet per second, or to 6 feet per second, in large wheels. Hence, he argues, that it is practicable to increase the efficiency of the best overshot wheels, as now usually made, at least 10 per cent. by this application. The only objections urged against the use of the conduit are of a practical character, relating to the difficulty of making it fit close, of repair, &c.; but however these may have applied to the rude workmanship of the older wooden wheels, with wood or stone conduits, they are unimportant, as referring to modern water-wheels made of iron. The conduits may be also made of cast-iron, provided with adjusting screws, and hence of being always kept fitting, readily repaired, and capable of being withdrawn from the circumference of the wheel in time of frost, &c.

The paper is illustrated by a drawing, showing the elevation and partial sections of the experimental apparatus, and a diagram showing the full size of the loaded arc of each model.

Mr. Farey observed, that the result arrived at by the experiments, appeared to correspond nearly with those recorded by Smeaton, who had experimented upon, and used practically both kinds of wheels. The buckets of the model wheels used in the experiments did not appear to be of the best form, and they were entirely filled with water; hence an apparent advantage had been obtained, by the use of the circular conduit to retain the water in the buckets. But that would not be realized in practice, for as the form of the bucket regulated the point at which the water quitted it, and it was the practice of the modern millwrights to make the wheels very broad, in order that the buckets should not be filled to more than one-third of their depth, the circular conduits became less useful, and in fact were now seldom used. Smeaton's practice was, to entirely fill the buckets with water, but he never adhered to the slow velocity of revolution which he recommended theoretically in his paper to the Royal Society.

Mr. Fairbairn had adopted broad wheels with an improved form of bucket, partially filled, and had obtained a more regular motion, particularly at high velocities.

Mr. Farey promised to present to the Institution, a copy of the method of calculation adopted by Smeaton for water-wheels.

Mr. Taylor corroborated Mr. Farey's statement of the advantage of using broad wheels, with the buckets of a fine pitch and partially filled; circular conduits then became unnecessary: this was practised among the millwrights in North Wales with eminent success, and a velocity of six feet per second was given to the wheel.

Mr. Homersham believed that in Smeaton's latter works he increased the velocity of his wheels to six feet per second.

Mr. Rennie gave great credit to the author for the ingenuity of the apparatus with which the experiments were tried, and for the clearness of the tabulated results; but owing to the necessary limited size of the model wheels, he feared the results could not be relied upon for application in practice to large wheels. The experiments of Borda, Bossut, Smeaton, Banks and others, were all liable to the same objection.

The best modern experiments are those by the Franklin Institute, by Poncelet, and by Morin.

The result of these might be taken thus:

Undershot wheels,	the ratio of	power to	effect	varied from	0·27 to 0·30
Breast wheels	,,	,,	,,	,,	0·45 to 0·50
Overshot wheels	,,	,,	,,	,,	0·60 to 0·80
Average	,,	,,	,,	,,	0·60

The velocity of the old English water-wheels was generally about three feet per second; the American wheels four feet, and the French wheels six feet: this latter speed was now adopted by the best millwrights in England. Mr. Hughes, at Mr. Gott's factory at Leeds, and Mr. Fairbairn, had found advantage from it; the latter also had a particular contrivance for carrying off the air freely from the buckets.

It was important to regulate the thickness of the sheet of water running over the shuttle upon the wheel; four to five inches was found in practice to be the maximum depth allowed.

The object being to utilize the greatest height of fall and the greatest available quantity of water, by means of properly constructed openings and such sluice-gates as were first introduced by the late Mr. Rennie for the breast-wheels constructed by him, instead of penning up the water in a trough, it was made to flow in a sheet of regular thickness over the top of the shuttle, and by a self-regulating apparatus to adjust itself at all times to the height of the water; thus obtaining the advantage of the full height of the fall at its surface, and obviating the necessity for the apparatus proposed by Mr. Mallett.

Mr. Mallett begged to dissent from the validity of the objections which had been made to the practical value of his experiments. With respect to the form of the bucket, that used by him could not, he contended, be called a bad form, although it might be susceptible of improvement; but as the experiments were altogether comparative, it was foreign to the question whether the form was bad or good, the same having been used in both wheels.

As it was shown that a certain relation subsisted between two water wheels with the same total descent, but with different diameters, as to their co-efficient of labouring force, a proportional relation would exist with any worse or better form of bucket. The results considered as absolute measures of effect, being obtained with a form of bucket which approached nearer to the best forms now in use, than did those of Smeaton or any other experimenter, were more applicable to modern practice, and therefore he must consider his results, as not without utility.

With regard to the custom of only partially filling the buckets, it must be remarked that buckets of the best forms begin to spill their contents before arriving at the lowest point of the loaded arc; the partial filling could, therefore, only palliate the evil which the circular conduit was designed to remedy. He must, however, contend that a positive disadvantage attended the partial filling. A permanent loss of fall was produced equal to the distance between the centres of gravity of the fall, and of the empty portions of the top bucket at the moment it had passed the sluice; this distance could be but little varied by the fineness of pitch of the bucket, and depended more upon the depth of the shrouding. That there was a constant loss of labouring force by a practical diminution of the effective leverage, or a reduction in the "moment" of the loaded arc. That as the wheel revolved, the centre of gravity of the fluid contained in each bucket, as it approached the lower portion of the loaded arc, was transferred to a greater distance from the centre of motion even before the contents commenced spilling; but the angular motion of the centre of gravity of any one bucket was at first that due to its distance from the centre of motion of the wheel, or to its radius; and as the radius increased, a greater angular velocity would be acquired by the water which had changed its position on approaching the lower point of the wheel; but this increased velocity was given at the expense of the power of the wheel, and hence a partially filled bucket would, he contended, be always attended with a loss of labouring force. To the last objection, a full bucket was not liable.

From all these reasons, he felt justified in concluding, that the use of the circular conduit was more advantageous than the practice of partially filling the buckets.*

With respect to the shuttle delivering the water over the top, where the head of water and the fall were constant, no advantage could be obtained by the use of a wheel greater in diameter than the total descent; it was assumed that this form of shuttle would be used in order always to deliver the water as high as possible upon the periphery of the wheel; but the question was, "If the head be variable, what should be the diameter of the wheel to secure the best effect?" The paper showed that a wheel whose diameter was equal to the total descent, when the head was a maximum, did not always give the greatest average labouring force. The question was therefore independent of the sort of shuttle used; it assumed the power of always admitting the water upon the wheel at the highest point of the total descent, and sought to establish the best relation between the diameter of the wheel and the whole descent when the head alone was variable, according to given conditions. The results of this part of the investigation, therefore, while they admitted the full value of Mr. Rennie's shuttle, went further, and pointed out the limits of its useful application.

He was fully aware of the prejudice which existed against the circular conduit, and once participated in it; but his attention had been forcibly drawn to it in his practice, and having used them very beneficially upon wheels of 40, 50, and 60 horses' power, which he had constructed for mining purposes, he wished to draw the attention of the profession to the consideration of their practical merits when adapted to good wheels.

English Marble.—A bed of variegated marble has been discovered in a limestone quarry, belonging to George Pybus, Esq., of Middleton Tyas, near Richmond, Yorkshire. A small piece has been dressed by a skilful workman; the polish is beautiful, and the marble seems likely to be brought into general use.

THE PYRAMIDS OF GIZEH.

At the Royal Institute of British Architects, on the 6th ultimo, a letter was read from Mr. Perring, containing some remarks on the great Pyramid, accompanied by a model.

"The model is on a scale of 30 ft. in the inch, and represents the pyramid in its original condition,—that is, immediately after the sarcophagus was placed therein, and before the passages were filled with stone blocks closing the entrance. From an examination of the ancient Egyptian cubit now remaining, I deduced the length to be 1·713 English feet, divided into four palms, each of seven digits. This measure, when applied to the pyramids, agrees as closely as to render its correctness certain, and I proceed to mention a few of the more obvious results in the edifice before us. The base covered a square of 118 cubits on each side, which, from a statement of Pliny, I take to have been equal to eight Egyptian jugera, or acres; and this supposition is somewhat confirmed by finding the second pyramid would then cover seven, and the third, one and three quarters of these supposed jugera, and so on with the other pyramids of Egypt. The height of the great pyramid appears to have been 280 cubits, being a proportion of height to side of base of 5 to 8; and I may here mention that several other pyramids have the same proportions. This gives the following ratio on a direct section: As half the base is to the perpendicular height, so is the apotheme, or slant height to the whole base; or for each side it may be thus stated as

Rad. Tang : : Sec : 2 Rad.

"Sir John Herschel having the angles only of the pyramids and their passages before him, gave his decided opinion that they were "not connected with any astronomical fact, and probably adopted for architectural reasons;" and the knowledge of the above proportions will I think lead to the same conclusion; for with the most solid and enduring shape possible, the builders obtained a mathematical symmetry which no other proportions could give. Although this pyramid was nearly 480 feet in perpendicular height of solid masonry, the pressure of the enormous mass is so distributed, that the lower courses have only to sustain about 25,000 lb. on the square foot, whilst the material is equal to at least 1,100,000 lb.; therefore it is evident that the main objects of the architect:—viz., stability and eternal duration—were well effected. The inclination of the entrance passage of the great pyramid was regulated by a proportion of 2 to 1. that is, two feet horizontal to one foot perpendicular.

"The same mode of regulating the angles is observable in every instance; thus where inclined blocks were used to cover an apartment, a certain portion of the width of the room was taken for the rise or pitch: as in the queen's chamber, where the rise is a third of the width of the apartment, and also the angle of the air passages leading from the king's chamber to the exterior, have a rise of one perpendicular to two horizontal. From finding, in every case, that the angles were thus regulated, I have come to the conclusion that the Egyptians, at the time of the erection of these mighty monuments, possessed no knowledge of the division of the circle into degrees, but that their angles were regulated by the proportion of base to perpendicular height; in fact, the tangential measure of the angle, and not its abstract measurement. That they learned to divide the circle into degrees at a later period is highly probable, as they were celebrated for their astronomical knowledge.

"In every part of the pyramids evidences of premeditated and careful design are apparent; but my present purpose is to draw attention to the more striking points in the great pyramid only. The situation of the apartments in the pyramid appear to have been regulated as follows —

Height from base (external) to floor of passage of queen's chamber	40 cubits
From the above to floor of king's chamber, or principal apartment	40 "
From the above to top of upper chamber	40 "
From the above to apex of pyramid	160 "
Total	280 cubits

Making 280 cubits in perpendicular height, as above stated. The floor of the subterraneous apartment was also 60 cubits below the base of the pyramid."

ROYAL COMMISSION OF FINE ARTS.

Her Majesty's Commissioners hereby give notice:—

1. That the cartoons or drawings intended for competition, according to the notices published in April and July, 1842, will be exhibited in Westminster Hall, whether they are to be sent between the hours of 10 and 5 on any day, Sunday excepted, during the first week in June next, when agents will be in attendance to receive them, but no drawing will be received after Wednesday, the 7th of June.

2. Each candidate is required to put a motto or mark on the back of his drawing, and to send, together with his drawing, a sealed letter containing his name and address, and having on the outside of its cover a motto or mark similar to that on the back of the drawing. The letters belonging to the drawings to which no premium shall have been awarded will be returned unopened.

3. The title of the subject of each drawing, together with the quotation, if any, to illustrate it, must be affixed either to the back or front of the drawing.

4. Each drawing is to be sent upon, or accompanied by, a stretching-frame; but no ornamental frames in addition to the stretching-frame will be admissible.

5. The artists or their agents may attend to examine the works sent by them, and to re-stretch such drawings as shall have been detached from their stretching-frames and rolled for the convenience of carriage.

6. No drawing will be allowed to be re-touched after having been received, except to repair an injury occasioned by accident, and then only by the artist himself.

7. Every possible care will be taken of the works sent, but in case of injury or loss, the commissioners will not be responsible.

8. All the drawings will be exhibited, and catalogues will be published.

9. The names of the judges appointed to award the premiums will be made known.

By command of the Commissioners,

Whitehall, March 24. C. L. EASTLAKE, Secretary.

THE NEW HOUSES OF PARLIAMENT

REPORT FROM THE SELECT COMMITTEE.

That the committee have met and considered the subject-matter to them referred, and have examined witnesses, and have come to the following resolution, viz., That considering the great inconvenience of the present House of Lords, and that such inconvenience will be greatly aggravated by the progress of the new buildings before the commencement of the session of 1844, no delay should take place in the building and preparing the new House of Lords beyond what is absolutely required for the safety of the work; that the architect be directed so to conduct his operations as to secure the occupation of the new House of Lords, with temporary fittings, at the commencement of the session of 1844; that in case the architect in the progress of the work of the new House of Lords shall find that more time will be required in consequence of any apprehension of injurious consequences to the building, he shall report the same to the Commissioners of her Majesty's Woods and Forests, in order that such report may be communicated to this house in due time; that it does not appear to the committee that it is advisable that any alterations in the ventilation of the present House of Lords, which would lead to additional expense, should be adopted; and the committee have directed the minutes of evidence taken before them to be laid before your Lordships.—*March* 13.

A return made to the House of Commons, published 27th ult., states that the total amount already expended for building the new Houses of Parliament is £380,483 10s.; the amount voted has been £138,500, and consequently £58,016 10s. is in hand unexpended, which will be required for works now in progress of completion. It is estimated that a further sum of £578,424 12s. 9d. will be required to complete the buildings. The total amount of Mr. Barry's estimate will therefore be £1,016,924 12s. 9d., besides what will be required for completing the landing-places, making good the pavings, furniture, and fittings, and for decorations by works of art.

The House of Commons, on the 27th ult., voted an additional grant of £110,000 towards the works.

NEW INVENTIONS AND IMPROVEMENTS.

DREDGE'S SUSPENSION BRIDGE.

The very economical, simple, and powerful principles of the lever in the construction of bridges, may be illustrated thus. A bridge is two arms united at the ends of the chains, the centre, where weight begins and increases from thence progressively, as the chains increase in magnitude and power to the points of suspension. This is effected by an oblique instead of a vertical connection of the platform to the main chains, which fixes all horizontal force in the horizontal line, and gives to the stability of a bridge the most valuable assistance, as is proved by the numerous bridges already erected upon the principle in various parts of Great Britain.

Its truth may also be easily understood by the following experiments. Cut the chains in the middle and the bridge will stand as firm as ever, there being no strain there; then cut the platform in the middle and it will be separated into two independent brackets, each supported by the chains and the strength of the horizontal line against the abutment. The force required to resist this tendency, is a measure of the power conferred upon the bridge, by reason of the oblique connexion of the horizontal line to the chains, independent of the advantage gained by tapering them. On the other hand, cut the chains of a common bridge at the centre, it will destroy the structure; or cut the platform in the middle and leave the chains entire, then it will be seen that there is no tendency of thrust against the abut-

ments, nor any horizontal power in the platform, and that it is the chains only which sustain the structure. In a chain or rope in a pendent curve this cannot be avoided, but in a bridge which consists of curved and horizontal lines, it is clear that the vertical and horizontal forces should be divided, as it is sufficient for the chains in any bridge, in their position of reduced power, to support themselves, the platform and the transit loads; and, independently, it is very clear that the horizontal force snould not be in the chains to facilitate their destruction, but in the horizontal line, where it cannot act in the direction of gravity, but where it is as essentially useful towards the maintenance of the structure, as are the chains themselves. It may be remarked that this system facilitates the manufacture of bridges, out of the cheapest and most durable materials—it enables their strength to be computed as easily as the contents of a block of marble is ascertained—requires but one lamina of timber for the roadways, and presents but little surface of resistance, therefore the wind cannot affect it, nor is any longitudinal trussing required, as in other bridges, whose equilibrium is easily affected by the slightest force, because they rest on their centres, similar to the logan stone.

A. Z.

IMPROVEMENTS IN METAL FOR SHIPS, &c.

Mr. William Fairbairn, of Manchester, engineer, has obtained a patent for "*certain improvements in the construction of metal ships, boats, and other vessels; and in the preparation of metal plates to be used therein.*"—They consist in preparing or rolling the iron intended to be used in the construction of ships and vessels, by forming at each edge, and the whole length of the plate, a raised border,—or, in other words, the plate is made at each side or edge, where the rivets pass through, something like double the thickness of any other part of the plate: one side of the plate being plain, which is to be the outside in the construction of a vessel, the other side having two projecting edges, or borders. The rivet-holes on the plain side of each plate are to be countersunk, so that the head of the rivet may be flat or flush with the face of the plate; and in joining two or more plates together, they are not to overlap each other, as hitherto practised, but the plates are placed with their edges together: and behind the two is placed a metal band, bar, or rib, perforated with a double row of holes, to correspond with the holes in the edge of each plate, and the whole are firmly rivetted together so as to form a water-tight joint; and where greater security or strength is required, the metal bands or bars are made in the form of a T, or with a projection on the back side; by this arrangement the resistance of a vessel in the water will not be so great, and the plates at the parts where the rivets pass through will be equal in strength to any other part of the plate; whereas, in those of ordinary construction, the plates are considerably weakened by making the rivet-holes, as such parts have always been found to give way when the plate itself has remained entire.—*Record of Patents.*

IMPROVEMENTS IN CHIMNIES.

M. Eugene de Varroc, of Bryanstone-street, Portman-square, has obtained a patent for "*apparatus to be applied to chimnies to prevent their taking fire, and for rendering sweeping chimnies unnecessary.*"—This invention relates to the application of reticulated metal surfaces, at the commencement, or near the entrance, of the chimney, in order to prevent the passing of the flame, and also to intercept the soot. The apparatus consists of two cylinders of wire-cloth, one within the other, but so constructed that the surfaces of the two cylinders touch, or are in contact with each other. The inventor prefers to make the cylinders of wire-cloth, having sixty-four holes to the square inch, or closely perforated metal plates may be employed, but such will not be found as useful as wire-cloth. The cylinder, which is mounted upon an axis, is fixed in the chimney, as near the fire as convenient, the flue or chimney being so constructed as to prevent any passage for the smoke but through the double-wire cylinder, the wires forming the reticulate, or open work, of one cylinder, being made to cross those of the other cylinder. By this arrangement the flames and soot will be prevented from passing through the cylinder; but there will be sufficient draught through the cylinder for the fire, and the chimney beyond the apparatus will not be coated with soot, the same being deposited on or about the apparatus, which will require to be brushed off every morning, and, if desired, the cylinder can be turned partially round, so as to present another part of its periphery. A modification of this apparatus, composed of a number of perforated plates, and arranged in a rectangular form, is shown, as being applied to the chimney of a steam-engine boiler; in which case there are brushes constructed for clearing the same occasionally from soot.—*Ibid.*

A FIRE ESCAPE.

A correspondent suggests the following simple plan for a fire escape:—

1st. Two ropes of 40 feet in length, each attached to a small chain also 40 feet in length, the end of each chain armed with a spring hook.

2nd. A stout sack of incombustible material (like the fire-proof dresses), open mouthed, with a metallic rim, about four feet deep, and wide enough to hold two persons, with two spring hooks on the opposite sides of the metallic rim, and connected therewith by a small chain of 9 inches long.

These articles should be brought to the spot on the first alarm of fire by a police constable. One rope and chain should be carried into the house next adjoining on the right of the one on fire, and while the rope is held fast, the chain should be dropt from the upper window till it touches the pavement; and the same should be done with the other rope and chain from the house on the left side; the two chains should then be hooked together by the policemen or neighbours. The escape sack should immediately be attached to the centre of the combined chains, and be rapidly drawn up to any window where a person may appear in danger. The moment the individual has got into the sack, one rope must be eased off, so as to allow the other rope to become perpendicular, when the rescued party may be taken in at a lower window of the neighbouring house, or lowered to the pavement; the rescuers giving the rope a half turn round a bed post, so that the lowering may be effected discreetly. It need scarcely be added, that this operation may be repeated several times in a minute, if there should be more individuals to be rescued. The sack, when manufactured, should be steeped in some solution prepared to resist combustion, and care should be taken that the ropes are not unnecessarily exposed to flame.

FLAX MILL AT CASSANO, IN LOMBARDY.

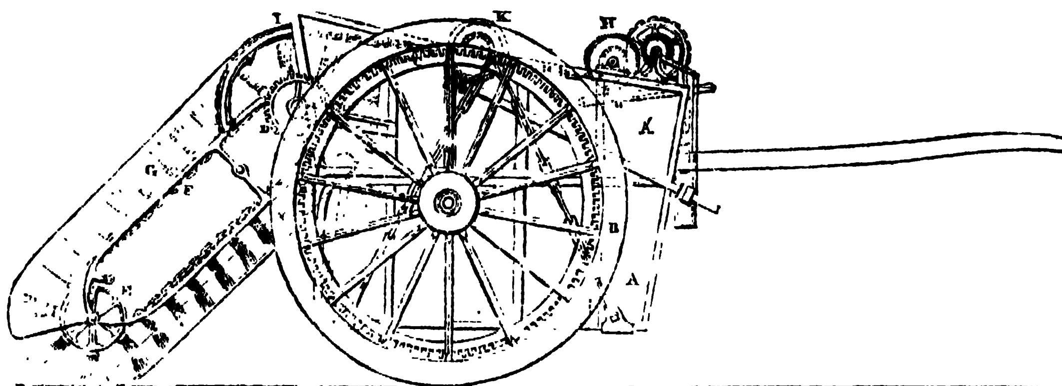
A flax and power loom mill has been established at Cassano, which has excited a good deal of attention in Italy. It belongs to Messrs. Battaglia and Co., and the works were erected by Mr. Albano, C. E., of London. The mill is for flax and hemp, and is divided into three compartments, containing upwards of 8000 spindles, set in motion by a water-wheel worked by the Adda, and 16 ft. in diameter, by 21 ft. or 24 ft. broad. This wheel is of cast iron, except the floats, which are of sheet iron, and the whole weighs 36 tons. To this wheel are attached apparatus for governing the velocity of the machinery, lifting weights to the upper stories, and working fire-engines. In the factory is also included a steam drying apparatus. Altogether the arrangements of the establishment and the adaptation of the machinery are looked upon as conferring great credit on the engineer, and has given great satisfaction to all parties concerned.

THE THAMES TUNNEL.

This important undertaking was opened for foot passengers on the 25th of March last. Thus, after many years of anxiety and difficulties, perhaps without parallel in the history of great Public Works, the practicability of forming a thoroughfare for carriages and foot passengers under a deep navigable river, and without interruption to the navigation, is proved and executed. The obstacles, which have from time to time impeded, and all but stopped the progress of the Tunnel, have been numerous. The work was commenced in 1825, but was stopped in 1828, by an irruption of the Thames. From that time to the spring of 1835 no progress was made. In this year, under the sanction of an Act of Parliament, the Treasury allowed the Exchequer Loan Commissioners to advance, out of the grant voted for Public Works, the money necessary to complete the Tunnel; and it was again commenced and has been continued with few but inevitable interruptions and delays to the present time, when, as the Directors have stated, it is securely completed, and is now thrown open to the Public as a thoroughfare for foot passengers. The two roadways for carriages under the river are also perfectly completed. From its commencement to the present date there have been but 11 years within which the excavation could be carried on. And during this time, for nearly two years or ninety-nine weeks, the works were suspended from circumstances beyond the control of either the Directors or the Engineer. The work has been in fact executed in about 9 years of actual work, at a cost of about £116,000, including property and expenses of every kind, with the particulars of which the Proprietors have been accurately and annually acquainted. The actual Tunnel of 1200 feet was executed in eight years. The Carriage-way descents are now alone wanting to complete the work. They are susceptible of being contracted for in the ordinary way.

The Nelson Monument.—The whole of the leaves, roses, and parts of the Corinthian capital, to be placed on Nelson's monument, Trafalgar-square, have now been cast at the foundry in the Royal Arsenal, Woolwich, with the exception of four volutes. The latter ornaments are most elaborate in their detail, and some idea of the difficulty of making a casting in one piece may be formed, when it is stated that the mould, before it is put together, has to be arranged from about 300 distinct parts, and great doubts are entertained of the artist, Mr. Clark, being able to cast the requisite quantity of metal in the peculiar form of this beautiful and graceful ornament. He is resolved, however, to make the attempt, and confidently anticipates being able to complete the undertaking with from 10 to 13 cwt. of brass. Had the usual mode been adopted the casting could not have been effected with less than about 40 cwt. of metal.

WHITWORTH'S PATENT SWEEPING MACHINE.



This machine, lately brought into operation in the town of Manchester, where it excited a considerable deal of public attention, has lately been introduced into the metropolis, and is now employed in cleaning Regent-street. It is the invention of Mr. Whitworth, of the firm of Messrs. Whitworth and Co., of Manchester, engineers, by whom it has been patented. The principle of the invention consists in employing the rotary motion of locomotive wheels, moved by horse or other power, to raise the loose soil from the surface of the ground and deposit it in a vehicle attached. The apparatus for this purpose is simple in its construction; it consists of a series of brooms (3 ft. wide) suspended from a light frame of wrought iron, hung behind a cart, the body of which is placed near the ground, for greater facility in loading. The draught is easy for two horses, and throughout the process of filling, scarcely a larger amount of force is required than would be necessary to draw the full cart an equal distance.

The following description of the machine by a reference to the accompanying engraving, will explain its action. The cart is constructed with plate iron, and consists of two parts, A, A′, the lower part A is suspended to the upper part, and when filled is lowered and replaced with an empty one. To the off-side wheel, B, is attached, on the inside, a cog-wheel, C, which works into a pinion, D, on the end of a shaft the length of the back part of the cart, and fixed thereon are two pullies, 1 ft. diameter and 2 ft. 4 in. apart: two other corresponding pullies, L, are fixed upon a lower shaft, which is suspended to the upper shaft by a wrought iron frame, and over these pulleys pass two endless chains F, to which the brooms G, consisting of 29 rows, each 3 ft. 4 in. long, are attached. It will thus be seen, that when the large wheel of the cart is set in motion, it will, by means of the large spur wheel C, turn the pinion D, and with it the pulleys and the endless chain and brooms that pass over them and as these brooms come in contact with the road, they sweep the mud up the inclined plane into the bottom part of the cart A. For the purpose of raising the brooms from off the ground there is an apparatus, H, consisting of an endless screw working into a bevel wheel upon a shaft which passes across the top of the cart: upon this shaft are fixed two pulleys, to which are attached two chains, which pass along the top of the cart and over the quadrants I, at the back, and there fixed to the iron frame of the apparatus,—so that when the endless screw is turned the chains are coiled round the pulleys, and raise the apparatus to any height it may be requisite. For the purpose of removing or emptying the lower portion of the cart, it must be raised to a horizontal position; as this apparatus is raised, it throws itself out of gear by means of a lever attached to a clutch fixed on the end of the pinion shaft D. To the apparatus H there is another motion attached for regulating the pressure of the brooms on the ground, according to the state of the weather and the nature of the surface, consisting of a series of weights in the box in front, suspended to two chains, which pass over pulleys on the axle of a wheel that works into another wheel on the same shaft as the first wheel described of the apparatus H.

There is also another apparatus, K, for raising and lowering the lower part of the cart, consisting of an endless screw working into a cog-wheel, the shaft of which passes across the top of the cart, and on each end are pulleys, round which chains are coiled that suspend the cart on each side.

Provision is made for letting off the water collected in the cart, by means of a pipe, having its interior orifice some inches above the level of the mud after settlement the cart, when full, is drawn to the side of the street, at some distance from a sewer grid, and the pipe plug being withdrawn, the water flows into the channel. A slight modification of the original form of the machine, by bevelling the cogs of the large spur wheel, C, throws the machinery more to the near side, and enables it to sweep close up to the curb-stone of the foot-pavement; and the hands before required to clean out the gutters are now dispensed with. An indicator, attached to the side of the sweeping apparatus, shows the extent of surface swept during the day, and acts as a useful check on the driver. It also affords the opportunity of hiring horses to work the machine over a given quantity of surface, the rate of hire being per 1000 yards actually swept.—This will be found convenient where parties working the machine do not keep their own horses, and will tend to facilitate the introduction of the new system under management of the local authorities.

Where provision cannot be conveniently made in large towns for deposit in yards at proper intervals, the patent machine is constructed of two parts, as above described, viz., an upper, A′, carrying the sweeping apparatus, and a lower, A, consisting of a loose box, suspended from the upper, and capable of easy detachment. Each machine having two or more of these boxes, A, may be kept constantly at work, depositing the full box in a suitable place, and taking up an empty box before provided,—a skeleton cart being afterwards employed to convey the loaded boxes to the place of ultimate deposit. No difficulty has been found to arise in the management of the machine by ordinary drivers. It has been worked regularly on every kind of street surface—the round and square set stone,—the Macadamized road, —and the wood pavement; all of which are found in the districts before mentioned. Its peculiar advantage, as applied to wood pavement, in preventing the slippery state of the surface so much complained of, has attracted particular attention, and will, no doubt, tend to facilitate the general introduction of that useful invention. By the use of proper precautions in cleaning and oiling the machine before setting it to work, the friction of the working parts may be materially reduced,—a point of great importance, in reference both to the consumption of horse power and the cost of repairs. The wear of the brooms, which at first was considerable, has been diminished more than one-half, by the action of the regulating weights before mentioned. A product of South America, called by the Portuguese "Piassava," forms an excellent material for the beard of the brooms, having great pliancy and strength combined, and also remarkable degree of durability.

Two machines are advantageously worked together, one a little in advance of the other. Not only is the operation of cleansing a particular street thus effected more rapidly, but the two drivers can occasionally assist each other, and one of them (at higher wages) may exercise a supervision over both machines.

The success of the operation is no less remarkable than its novelty. Proceeding at a moderate speed through the public streets, the cart leaves behind it a well swept tract, which forms a striking contrast with the adjacent ground. Though of the full size of a common cart, it has repeatedly filled itself in the space of six minutes from the principal thoroughfares of Manchester. This fact, while it proves the efficiency of the new apparatus, proves also the necessity of a change in the present system of street cleaning.

Another Great Blast at Dover.—On Wednesday, 1st March, about four o'clock, another great blast took place at the South-eastern Railway works, a little beyond the Rounddown cliff. This blast, as compared with that at the Rounddown (when 18,500 lb. of gunpowder were instantaneously ignited), was comparatively insignificant; but when we mention that 7000 lb. were fired at the present explosion, it will be seen that this insignificance was only comparative. The present operations, like the blast on the 26th January, were conducted by Mr. Cubitt, the engineer-in-chief to the South-eastern Railway, who, with Lieutenant Hutchinson and a number of the directors of the company, were present to-day, witnessing the blast. The effect of this blast has been quite as successful as that which effected the destruction of Rounddown. About 50,000 yards of chalk have been dislodged, ignition being communicated by the voltaic battery. Nine chambers were formed in the cliff, about ninety feet from its top, the object being to blow away the crown of the cliff, to render it safe for the railway carriages to pass on the sea wall under it. Like the explosion on the 26th of January, the present was effected with very little noise and smoke. The instant ignition was communicated the cliffs around trembled, and the immense mass of chalk burst out with a low booming noise, and the ruins were gently, though majestically, thrown down on the beach below; but, instead of, like those of the Rounddown, shoot out into the sea about 1,000 feet, they scarcely, we should say, extended 200 feet in any direction, after reaching the base of the cliff.

STEAM NAVIGATION.

"VIRAGO" STEAM FRIGATE.

The *Virago* is one of the second class frigates belonging to our service. Her dimensions are as follow:—Length between perpendiculars, 180 ft.; keel, 156 ft.; extreme breadth, 36 ft.; breadth for tonnage, 35 ft. 8½ in.; moulded breadth, 35 ft.; depth in hold, 21 ft.; tonnage, 994, N. M. She is fitted with two engines, of the collective power of 300 horses, manufactured by Messrs. Boulton, Watt, and Co., which are eminently novel in their arrangement, occupying less space than any yet employed in her Majesty's navy or otherwise; combining great strength with lightness of construction—facility of access to all the working parts with a ready and simple mode of handling them, being stopped and started with as much ease as if they were intended for river use. Each cylinder is supported upon a foundation plate connected with the condensers, situated in the middle line, forming one casting, and containing the two air pumps, which are worked by an auxiliary beam from a crank on the engine shaft; this arrangement having been first adopted by them as far back as June, 1841 (see our *Journal*, Feb. 1842), and which arrangement they have patented with other improvements in the oscillating engine. The steam can be expanded at various parts of the stroke, and the valves for that purpose are simple, and work without the usual noise attending those generally employed. There are four boilers, situated close to each other, but having a clear passage round the sides of 18 inches in width. They have stop-valves to each, so that they may be worked separate or together, as occasion may require. There are 16 fire places, and two firing floors—one forward, towards the engines, the other abaft—to which access is afforded by the above mentioned passage of 18 inches. The chimney is surrounded by a water case, from which the boilers are fed with water at nearly a boiling temperature, by which a saving of fuel is effected, and the risk of fire diminished. This plan was originally adopted by this firm shortly after the destruction of the *Prince Regent* by fire in 1817.

The entire of the boilers and steam-chest is covered with felt, two inches in thickness, sewed on to canvas, protected by inch deal with iron tongues and finally coated with sheet lead to prevent any leak from the deck saturating either the wood or the felt. On each side of the engine and boilers are ranged the coal boxes, extending from bulkhead to bulkhead, and calculated to hold 23 days' consumption; the machinery is there protected from shot by the thickness of the stratum of coal, while the greater part of the engine is considerably below the load line.

The following are some of the principal dimensions of the engines: Diameter of cylinders, 61¾ in.; length of stroke, 5 ft.; connecting rod, 8 ft.; diameter of paddle wheel, 25 ft.; boards, 8 ft. long in two widths, each 12 in. The entire weight of these engines, boilers, and coal boxes, are 15 tons under that given to the Admiralty in the tender, being little more than 13½ cwt. per horse.

On the 11th instant an experimental trip, for a short distance down the river, was made in the presence of the government engineers, with which we understand they were perfectly satisfied. They will shortly proceed to Chatham, to be fitted with her rigging, &c., when it is presumed she will be forthwith commissioned.

THE "GREAT BRITAIN."—At a meeting of the Proprietors, held last month, the Directors reported that *The Great Britain* is in a very forward state The frame and hull are complete. The whole of the upper decks, as well as the decks of the forecastle, forecabins, and aftercabins, are laid and caulked; nearly the whole of the state rooms, and other joiner's work, is finished. The forehold, afterhold, and iron coal decks before the boilers and abaft the engines, are nearly finished. The boilers and funnel are fixed in their places, as are the cylinders, condensers, air-pumps, and other weighty parts of the engines. To add to her strength and diminish the apprehension of fire, the decks and partitions of the body of the ship occupied by the engines, &c., will be fitted up in iron. Nearly all the masts and spars are made, and should nothing unforeseen arise, she may be floated out within three months.—[The Directors take good care that the public shall be kept in ignorance of their proceedings as much as possible; for they will not allow any one to inspect the vessel or their works at Bristol, without an order signed by two Directors, and a contribution of 5*s* towards the sick fund of the workmen. Whoever heard of such a demand? Government allow the public freely to view all the works that are going forward in the public docks, and most of our first engineers will permit any respectable person to visit their works without such an extortionate demand. Lately a professional gentleman applied at the works for admission, and obtained an order from the Managing Director for his admittance, but was told by the porter that he must first pay 5*s*. for his admittance, which he very properly declined to pay, and consequently left in disgust without seeing the vessel.—EDITOR.]

THE "PENELOPE" STEAM FRIGATE.—**This large Man-of-War Frigate, which has been lengthened for the purpose of converting it into a first-class steam frigate, has been towed up the river Thames from Chatham to Messrs. Seaward's Wharf at Limehouse, to receive her engines. The engines are constructed on the Gorgon direct action principle, and occupy, comparatively speaking, a very small space for engines of their magnitude. The cylinders are 92 inches diameter, and 7 feet stroke, at 17 strokes per minute, the collective nominal power of the two engines is 660 horses, but she can be worked up to 750 or 800 H. P without incurring the slightest risk. She is fitted with Hall's patent condensers, and an ingenious contrivance for altering the throw of the eccentric rod which works the steam valves, by this contrivance the steam can be expanded to any degree, without the aid of an expansion valve; the air-pumps are of solid brass, there is also an ingenious contrivance for disconnecting the paddle-wheel shafts different to any before adopted. There are four boilers, which are tubular and only 9 feet long; the fire-grate is under the boiler; the fire rises from the grate up the back and returns through the tube to the front, it then returns again over the top to the up-take in the centre of the four boilers, which are placed in pairs, back to back. The chimney funnel is made like a telescope, the upper half slides down. When the vessel is completed, we hope that we shall be able to give a more minute description of the several improvements that we have now but slightly alluded to.**

THE HINDOSTAN STEAM-SHIP.—This steamer, it will be remembered, left Southampton on the 24th September for Calcutta She arrived at Madras on the 20th of December, having, including delays at the various intermediate ports of call, made the passage in 87 days. The time she was under steam was under 60 days, leaving 27 for stoppages and delays. She averaged 200 miles per day. She had 110 passengers to the Mauritius, and landed 25 at Point de Galla, Ceylon. The *Hindostan* proceeded on to Calcutta, whence she was to sail on the 14th of January for Suez. Captain Moresby, the commander, gives the following account of her performance on the voyage from England to India:—"This vessel is uncommonly easy in a head sea and contrary winds; she then shows off her power and good qualities to advantage; she neither rolls nor pitches much, steers well, and is easily managed in turning; sail when set does not increase her speed much, beyond what full power of steam will give her; it has one advantage—sail when set, the vessel requires less steam, therefore a saving of fuel. With a beam swell she seldom rolls at all; when steaming head to sea and wind, is very dry on deck, and does not take in water forward—instance the voyage from Ascension to the Cape of Good Hope against a strong south-east trade wind, she averaged against wind and current 190 miles per day. The north-east monsoon from Ceylon (Point de Galla) to Madras has been strong with a head sea against her and a current of 22 to 24 miles per day against her: yet she has made the distance in three days one hour."

STEAM NAVIGATION.—During the last month, a new steam vessel, fitted with a single engine of 30 horse power, has made several trips up and down the river. She has been built for the Watermen's Steam Packet Company by Mr. David Napier, of Millwall, whose two fast boats, the *Eclipse* and the *Isle of Thanet*, excited great attention on the Ramsgate and Margate station last year. The hull of the new vessel is formed of iron, and has a false bottom, which forms a condenser. The steam passes into the condenser, and cold water under and over it. The machinery occupies a very small space, and the consumption of fuel does not exceed a ton and a half per day. With these very small means, Mr. Napier has succeeded in obtaining an extraordinary speed. Her ordinary speed with the tide is stated to be 18 miles an hour, but she is said to have actually proceeded down the river with the ebb tide at the rate of 19 or 20 miles an hour In one of her recent trips she performed the distance from London Bridge to Greenwich Hospital, exactly 5 miles, in 16 minutes, and on the following afternoon the same distance was effected in one minute less. She is to be called *Waterman, No.* 9, and is intended to ply between the Adelphi pier and Woolwich.

THE LARGEST STEAM FRIGATE IN THE NAVY.—The Lords Commissioners of the Admiralty last year approved of a plan submitted by Mr. Oliver Lang, Master-shipwright of the Woolwich Dockyard, of a steam frigate on a far larger scale of dimensions and power than any hitherto constructed, and ordered her to be built at Woolwich, and named the *Terrible* It is now contemplated that this splendid steam frigate shall be built at Deptford Dockyard on the same slip from which the *Worcester* 50 gun ship will shortly be launched. She is to be of the following dimensions.—

	Feet.	Inches.
Length between perpendiculars	226	0
Keel for tonnage . ..	196	10¼
Breadth extreme	42	0
Depth in hold	27	0
Burden in tons	1847	

She is to be supplied with Maudslay and Field's patent double cylinder marine engines of 800 H. P. The cylinders will be 72 inches in diameter, and the erection of the engines alone has been contracted for at the cost, including the boilers, of the large sum of £10,250. The engine-room will be ...ing splendid dimensions —75 ft long, 38 ft broad, and 27 ft ... The weight of the engines and requisite gear connected with them will be upwards of 500 tons. The diameter of the paddle-wheels is to be 34 ft by 13 ft in breadth. The coal-boxes will contain 800 tons of coals, and altogether this great vessel will far exceed in length and other important points the largest ship-of-the-line ever constructed in this country.—*Times*.

ST. PETERSBURG.—A joint-stock company has been formed for the purpose of establishing a communication by steam boats along the south coast of Lake Ladoga, between Schlusselburg and Sermu, at the mouth of the Sabr, and along the coast of Friedland, between Schlusselburg and Sest bol the boat to touch at Kexholm, and the coasts of Lennowetz and Walgam. At present 800 vessels from Sermu annually navigate the lake.

PORTSMOUTH DOCK-YARD.—The Hon. Captain Corry, one of the Lords of the Admiralty, and Captain Brandreth, of the Royal Engineers, the Civil Engineer to the Admiralty, have visited this dock-yard during the last month upon official business. It is understood that one of the objects they had in view was to ascertain the most eligible position at the north part of the yard to make a basin for steam vessels of the largest class, as the Commissioners of the Admiralty have it in contemplation to make this port, as well as Woolwich, a rendezvous for the equipment of steamers. A site has been selected which it is considered will answer the purpose.

MISCELLANEA.

Improvements in Liverpool. Most of our readers are aware of the contemplated alterations in the vicinity known for many years as the New Haymarket, which, being now numbered amongst the things that were, the surrounding straggling houses, timber-yards, &c. are gradually disappearing and giving place to magnificent edifices, which will impress upon strangers entering the town some idea of its immense wealth, extent, and importance. The façade erected at the terminus of the Liverpool and Manchester and Grand Junction Railways, was the first great step towards forwarding this desideratum. The well known skill of Mr. Elmes, of London, having been called into requisition, (whose designs have met with universal approval) we may with becoming pride and pleasure look forward to the completion of the Assize Courts and St. George's Hall within the time stipulated. From the top of St. John's-lane, extending along the west side of Lime-street to Ranelagh-street, a distance of between four hundred and five hundred yards, the entire range of houses, sheds &c. are to be pulled down, the space widened, and buildings of suitable magnitude erected, which, when accomplished, we may with some degree of pride point to this locality as the centre of attraction in the good old town. Amongst the improvements above alluded to, we have been favoured with an inspection of the plans and elevations for an extensive and first-rate hotel, in the plain Italian style of architecture, which will be situated at the corner of St. John's-lane and Roe-street, the entrance facing the colonnade of the Assize Courts; and certainly a more desirable situation could not have been selected. The arrangements are to be on the most approved modern scale, and a handsome structure, we have no doubt, will be erected.—*Liverpool Mail.*

Liverpool.—The works at the intended Albert Dock and warehouse, on the west side of the Salthouse Dock, are rapidly advancing. The operation of piling is at present the principal occupation, and for this purpose several steam engines have been erected on the ground. Excavation is also going on in the centre of the ground, and building in other parts. The entrance into the Salthouse Dock is already formed, and the piling for the sea-wall is advancing. Several hundreds of men are employed on the works, and all seems to go on with great order, expedition, and precision.

The Royal Exchange.—Great progress is now making in placing the sculptured coping above the columns, as well as over the other parts of the building. The transition is more striking on account of the elaborate workmanship being all performed ere the stone is raised, and but a short time is now required with the improved machinery at command to fix it at once in its position.

The Alps.—A canal is in the course of formation for the purpose of irrigating the plains of Provence, in the summer months, with the waters which pour down from the Alps. Eight hundred labourers are at work on the canal, on which 1,200,000 francs have already been expended.

Claughton and Birkenhead Waterworks.—The spirited company connected with this enterprise, which will confer the most invaluable boon on the inhabitants of Birkenhead, having, after immense labour, found abundance of water, the first stone of the works about to be erected was laid by John Jackson, Esq., on Tuesday, 14th March. The engine, which is thirty-horse power, is now in course of completion by Messrs Jones and Potts, of Neston. The buildings are to be erected by Messrs. Walker and Craven.

Grand Railway Junction.—A contract for forming the junction between the Manchester and Liverpool and the Manchester and Leeds Railways, at Hunt's Bank, has just been made between Mr. Pauling, of Manchester, and the former body. It will be carried on arches some 18 or 20 feet above the level of the streets. Its route will be through Salford. Report states that the contract is for something near £70,000, and that the work is to be complete in all in September next. This will unite the towns of Hull and Liverpool by one continuous railway, and prove the means of saving at least ten days in the transit of goods, when contrasted with the canal conveyance.—*Liverpool Mail.*

Machinery for Exportation.—We understand the machine makers of Lancashire and Yorkshire are busier than they have been for some years, their orders being principally for the continental market, indeed ever since the order in council was issued permitting the free exportation of cotton machinery, the trade of machine-making for the use of our foreign rival manufacturers has been more extensive than ever.

Mechanical Improvements.—An ingenious application of the common reading-desk to the purposes of newspaper reading has been recently contrived by a Mr. Joseph Schlesinger, an engineer, at Birmingham. It consists of a sliding stand, which supports a light frame fixed at a convenient angle, and capable of holding one or several newspapers by means of an iron cramp, which is opened by a lever. This apparatus will be a perfect luxury for clubs and offices.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM FEBRUARY 28, TO MARCH 24, 1843.

Six Months allowed for Enrolment, unless otherwise expressed.

John Heathcoat, and Ambrose Brewin, of Tiverton, lace manufacturers for "*improvements in the manufacture of ornamented net or lace.*"—Sealed Feb. 28.

Gottlieb Boccius, of New-road, Shepherd's Bush, for "*improved arrangements and apparatus for the production and distribution of light.*"—Feb. 28.

George Bell, of Dublin, merchant, for "*improvements in machines for drying wheat, malt, corn, and seeds, and for bolting, dressing, and separating flour, meal, and other like substances.*"—March 1.

John Frearson, of Birmingham, machinist, for "*improvements in fastenings for wearing apparel.*"—March 2.

Thomas Simpson, of Birmingham, manufacturer, for "*an improvement in buckles.*"—March 2.

Masta Joscelin Cooke, of Gray's-inn-square, solicitor, for "*improvements in the manufacture of artificial fuel.*"—March 2.

John Keely, the younger, of Nottingham, dyer, and Alexander Alliott, of Lenton, bleacher, for "*improvements in machinery or apparatus for drying or freeing from liquid or moisture, woollen, cotton, silk, and different fibrous materials, and other substances, and also for stretching certain fibrous materials.*" (A communication.)—March 2.

William Walker, of George-yard, Crown-street, Soho, coach-smith, for "*improvements in the manufacture of springs and axles for carriages.*"—March 2.

Charles White, of Noel-street, Islington, engineer, for "*improvements in machinery for raising and forcing fluids.*"—March 2.

Robert Stirling Newall, of Gateshead, Durham, wire-rope manufacturer, for "*improvements in the manufacture of wire-ropes, and in the apparatus and arrangements for the manufacture of the same.*"—March 7.

William Newton, of Chancery-lane, civil engineer, for "*improvements in machinery or apparatus for making pins.*" (A communication.)—March 6.

James Pilbrow, of Tottenham, engineer, for "*improvements in the application of steam, air, and other vapours and gaseous agents to the production of motive power, and in the machinery and apparatus by which the same are effected.*"—March 7.

William Betts, of Ashford, Kent, railway contractor, and William Taylor, of the same place, plumber, for "*improvements in the manufacture of bricks and tiles.*"—March 8.

William Kenworthy, of Blackburn, Lancaster, cotton spinner, for "*improvements in machinery or apparatus called 'beaming or warping machines.'*" March 11.

Charles Chilton, of Gloucester-street, Curtain-road, and Frederick Braithwaite, of the New-road, engineer, for "*improvements in machinery for cutting or splitting wood for fuel and other purposes.*"—March 16.

Arthur Chilver Tupper, of New Burlington-street, Middlesex, gentleman, for "*improvements in the means of applying carpets and other covering to stairs and steps, and in the construction of stairs and steps.*"—March 16.

Alexander Angus Croll, superintendent of the gas-works, Brick-lane, Middlesex, and William Richards, of the same works, mechanical inspector, for "*improvements in the manufacture of gas for the purposes of illumination, and in apparatus used when transmitting and measuring gas or other fluids.*" March 16.

Angier March Perkins, of Great Coram-street, engineer, for "*improvements in the manufacture and melting of iron, which improvements are applicable for evaporating fluids, and disinfecting oils.*"—March 16.

John Thomas Betts, of Smithfield Bars, gentleman, for "*improvements in the manufacture of metal covers for bottles and certain other vessels, and in the manufacture of sheet metal for such purposes.*" (A communication.—March 16.

Frederick Cook Matchett, of Birmingham, manufacturer, for "*improvements in the manufacture of hinges.*"—March 16.

Martyn John Roberts, of Brynycaran, Carmarthen, gentleman, for "*improvements in the composition of ink, blacking, and black paint.*"—March 16.

James Malam, of Huntingdon, gas engineer, for "*improvements in the manufacture of gas retorts, and in the modes of setting gas retorts.*"—March 16.

William Laycock, of Liverpool, merchant, for "*improvements in constructing houses and such like buildings.*"—March 16.

Wakefield Pim, of the Borough of Kingston-upon-Hull, engineer, for "*certain improvements in the construction or formation of buoys or other water marks.*"—March 18.

Alexander Simon Wolcott, of City-terrace, City-road, machinist, and John Johnson, of Manchester, in the county of Lancaster, machinist, for "*improvements in photography, and in the application of the same to the arts*"—March 18.

William Barker, of Manchester, millwright, for "*improvements in the construction of metallic pistons.*"—March 20.

Solomon Robinson, of Dudley, Worcester, roll-turner, for "*improvements in the manufacture of shot.*"—March 20.

Joseph Needham Taylor, of Chelsea, captain in Her Majesty's navy, and William Henry Smith, of 33, Fitzroy-square, civil engineer, for "*improvements in breakwaters, beacons, and sound-alarms; also in landing or transmitting persons and goods over or through strata or obstructions of any nature, all of which may be used either separately or in combination.*"—March 21.

Andrew Barclay, engineer and brass founder, Kilmarnock, Scotland, for "*improvements in lustres, chandeliers, pendants, and apparatus connected therewith, to be used with gas, oil, and other substances, which invention is also applicable to other purposes.*"—March 24.

Gregory Seale Walters, of Coleman-street, merchant, for "*improvements in the manufacture of chlorine and chlorides, and in obtaining the oxides and peroxides of manganese in the residuary liquids of such manufacture.*" (A communication.)—March 24.

Alfred Hooper Nevill, of Chicester-place, Grays-inn-road, corn dealer, for "*improvements in preparing lentils and other matters for food.*"—March 24.

ADVERTISEMENTS.

EMIGRATION.—LAND SURVEYING IN THE COLONIES.

MR. HENRY CASTLE, Lecturer on Land Surveying and Levelling, at King's College, London. Author of a Treatise on the same subjects, and formerly Boundary Commissioner to the Home District, Upper Canada, is forming a FIELD CLASS on the Circumferentor and the method of Surveying peculiar to new Countries.

Fee for the Course, to commence the 26th April, Five Guineas. Apply at 30, Queen-square, Bloomsbury.

P.S. The College Classes will be resumed at the same time.

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"A periodical that would give a decided and unbiassed opinion on those subjects has been much wanted, as most of the scientific journals of the day are too apt to state opinions favourable to the inventor or executor of a work of art, without considering that in so doing they are deceiving the public."—*Greenock Advertiser*.

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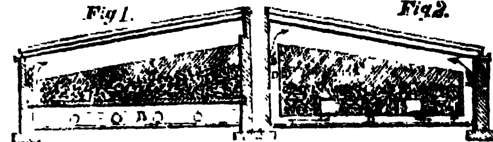
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J. THOMSON, late Head Gardener to His Grace the Duke of Northumberland, at Syon House, and for many years in the Garden Establishment of Her Majesty, has introduced an improved mode of applying the Pipe Tank and Trough System, for bottom and top heat to hot houses and other horticultural erections, by which the perpetual nuisance and labour attending the continual renewing of tan, dung, and other fermenting materials, commonly used to produce bottom heat, are obviated. The apparatus can be fixed so as to produce a humid or dry atmosphere at will: and the expence does not exceed half that of any other plan of hot water.



Pipes for Bottom & Top Heat. Troughs for ditto

The above plan of applying the Pipe Tank and Trough System of Heating, combined with his newly invented and economical boiler, has been adopted by, and may be seen at, the two largest Horticultural Establishments in Great Britain, viz., Messrs. Lees' Nursery, Hammersmith, and Mr. Wilmot's, Brentford or Isleworth.—Designs and Estimates for warming horticultural erections, public or private buildings, &c., may be obtained on application to J. Thomson, Landscape Gardener, 1 Chapel Place, Hammersmith.

J. T. has applied the above system for bottom heat to pines, and for other purposes at Lord Prudhoe's, and several other places in England, with great success, within the last six years.

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W. HOBCRAFT respectfully calls the attention of the above, and all persons requiring accurate Rules, Scales, and Mathematical Instruments, that from the advantages he possesses, being a Manufacturer, he is enabled to supply them with goods of a superior quality, at prices reduced considerably below those usually charged, by which from 15 to 25 per cent may be saved. Rules and Scales of every description for Mechanical and Scientific purposes made to order on the shortest notice. Levelling Staves, Optical and Philosophical Instruments, equally reasonable. Merchants, Captains, and the Trade supplied on advantageous terms. Country orders, containing a remittance or an order for payment in London, promptly attended to.

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SEYSSEL ASPHALTE COMPANY, "Claridge's Patent." Established March, 1838.—The extensive patronage which this valuable MINERAL production continues to receive from the most eminent ARCHITECTS and ENGINEERS in this country and abroad, distinguishes it from the numerous fictitious compositions which its reputation gave rise to, but which having been found very inferior to the original material, most of them have ceased to be used. Its merits being well known, it is only necessary to refer to a few of the public works already executed and now in progress.—On the London and Greenwich Railway, and Joint Station, London Bridge, 430,000 superficial feet; several thousand feet at the Great Western, Birmingham, Midland Counties, South-western, Brighton, Blackwall, and other Railways; covering of Arches at the South Metropolitan, Highgate, and Nunhead Cemeteries; the covering of the Casemates at the Perch Rock Battery, Liverpool; the Pavement in Whitehall; the Carriage-drives at the Horse Guards, and at the entrances to the Park by Apsley House; the Cells and other apartments of the new Prison at Hereford; several works at the Stations on the Dublin and Kingstown Railway; and many other public and private works in different parts of England, Ireland, and Scotland.

A Scale of Prices, with Books of Testimonials, can at all times be had at the Company's Depôt, where specimens of its various applications may be seen.

J. FARRELL, Secretary.

Seyssel Asphalte Depôt, Stangate, near Westminster Bridge.
March, 1843.

FROM "THE TIMES."

December 5, 1842.

"Many of our readers may, perhaps, remember that some years ago, and previously to the introduction of Asphalte into this country, we expressed our admiration of the pavement, composed of that substance, in Paris, and especially of that in the Place de la Concorde, the whole of which has been long since paved with Asphalte. It now behoves us to point out the piece of Seyssel Asphalte laid down in April, 1838, in Whitehall, opposite the Horse Guards, as equal to the pavement in the Place de la Concorde, or in any part of Paris, and considering that its thickness is only half an inch, its having so long stood the traffic of so great a thoroughfare, without any apparent change, except a greater smoothness of surface, is very remarkable."

ADVERTISEMENTS.

PRINCE'S PARK.

TO ARCHITECTS.

ONE HUNDRED GUINEAS will be paid in premiums for the best designs for four Terraces to be erected in the Prince's Park, now in progress near Liverpool.—Plans of the ground and full instructions may be obtained by applying to

Messrs. FOSTER and STEWART, or Messrs. A. and G. WILLIAMS. } Architects, Liverpool.

SMOKE NUISANCE.

THE METROPOLITAN IMPROVEMENT SOCIETY having, on the part of the public, determined to get abated the long-existing nuisances arising from furnaces used in the working of steam-engines within the metropolis, are desirous of receiving INFORMATION from public bodies, and also private individuals, who are suffering injury from such NUISANCES, in order that indictments may be preferred against the offenders; the same to be forwarded to James Anderton, Esq., the Honorary Solicitor of the Society, 20, New Bridge Street, Blackfriars, or to the Committee, at the Society's Office, 20, Bedford Street, Strand.

HENRY AUSTIN, Hon. Sec.

THE THAMES TUNNEL IS NOW AT ALL TIMES OPEN TO THE PUBLIC as a Thoroughfare for Foot Passengers, at a Toll of One Penny each.

By order of the Board of Directors,

J. CHARLIER, Clerk of the Company.

Company's Office, 2, Walbrook Buildings, City, 25th March, 1843.

N.B.—Steam Boats to Wapping, from Hungerford, Adelphi, Temple Bar, Blackfriars Bridge, Old Shades, Old Swan, and Adelaide Piers, London Bridge; and by Omnibusses to Rotherhithe from the West-end, and from Gracechurch-street, at every half hour.

ANTI-DRY ROT COMPANY—KYAN'S PATENT.

THE DIRECTORS of this Company having removed one of their 60-ft. hydraulic presses to their Station, City Basin, City Road, desire to draw the attention of the public to the great facilities they now offer for preparing timber of large calibre in a few hours. When the quantity exceeds 100 loads the Directors allow a considerable reduction in price.

GILLOTT'S PATENT FAN STOVE, for Heating and Ventilating Churches, Courts of Law, Hospitals, and all large public Buildings—it is particularly adapted for drying the walls of newly-built houses, for various manufactures where heat is required, without the possibility of accident by fire, as the apparatus is not required to be on the premises, but the hot air may be conveyed into the manufactory by a pipe, or pipes, and it would not ignite gunpowder. It is invaluable also for ships, as warm or cold air may be propelled into every part of them, either for warmth or ventilation. May be seen in use at J. L. Benham's, 19, Wigmore Street, Cavendish Square, and at 80, Great Queen Street, Lincoln's Inn Fields.

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R. HENESEY, of 18?, High Holborn, begs to announce that he has on hand a small STOCK of the choisest AFRICAN BLACK WOOD, the only importation for 30 years. This beautiful wood contains no acid, has a remarkably fine grain, is not liable to rust steel, and on this account is particularly recommended to the notice of surgical instrument makers: for eccentric turning its properties are invaluable. R. H. has always on hand at his warehouses Brazilian and French tulip, sandal, and violet woods; also the root of the olive tree, kiabooka, and a greater variety of curious foreign hard woods than can be found in any other establishment in the kingdom.

N.B. An immense assortment of veneers.

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WANTED, A PARTNER, in an extensive and well established IRONFOUNDRY and ENGINEERING CONCERN, in full work, in a populous manufacturing district in one of the Midland Counties. To a practical man, with a capital of from £1000 to £2000, the above presents such an opening as is seldom to be met with.—Apply to C. Y., at Messrs. J. Barker and Co.'s, Newhall Street, Birmingham.

TO ARCHITECTS.

A YOUNG MAN wishes to meet with an engagement in an ARCHITECT'S OFFICE, or to superintend the erection of works. Highly respectable references can be given.—Address, prepaid, to A. Z., Mr. Elliott's, 268, High Holborn, London.

SMOKE.—The following remarks on RODDA'S PLAN were made at the meeting of the Leeds Smoke Committee, held Jan. 26, 1843:—

The Rev. J. A. RHODES said, that, if the meeting would permit him, he would mention what plans he knew to be very effectual. He had been for years annoyed at his residence at Mytholm by the smoke arising from the mill of Messrs. Robinson and Co., at that place. He had remonstrated with them on the subject, but, being the owner of a mill himself, he thought it best to try to prevent smoke at his own mill, in order that, if he succeeded, he might have good grounds for his remonstrances with Messrs. Robinson and Co. The mill of which he was the owner was that of Messrs. Walker, at Milshay; and at it Mr. Rodda was employed, and he had since seen that gentleman's plan in full operation there, and had examined it closely, and certainly the apparatus had been put up to his (Mr. Rhodes's) entire satisfaction, and was quite effective in preventing smoke.—Mr. MACLEA had had Rodda's plan in use for six months, and he could testify to its good effects.

Mr. HOLDFORTH said that he had found Rodda's plan better than five or six other plans that he had tried. He had persevered in the use of Rodda's apparatus, which prevented smoke, effected a saving in the fuel, and had other advantages—such as raising the steam quickly, and keeping it up a regular height with very little attention on the part of the fireman. As soon as ever smoke was generated, the apparatus possessed means of destroying it; and the only time when there was smoke was when fresh coals were thrown on the fire, and then there was not much smoke, and that was not visible more than half a minute. The coals he was using were unriddled slack, which he found to answer very well, and his mill was quite free from smoke. He believed that Mr. Rodda's plan was applicable to dye-house pans and to all sorts of furnaces except to the rotatory (Brunton's) grates.

Mr ATKINSON inquired if any plan that was known could prevent a large quantity of smoke being emitted when a fire was first lighted?—Mr. HOLDFORTH replied that Mr. Rodda's did to a great extent.

Mr. LUCCOCK said that Messrs. Pease and Heaton, and also Mr. George, had applied Rodda's plan to their dye-pans, and found it to answer exceedingly well.—Mr. HOLDFORTH had seen the plan in operation at Messrs. Pease and Heaton's, and he could testify that it was quite effective. It was only when Mr. Rodda's instructions were not obeyed that smoke was generated. With regard to the best means of ensuring attention on the part of firemen, Mr. Holdforth stated how he did with his men. He went to the fireman and said, when the plan was in effective operation, "Now, you see there is no smoke, and you see, if the apparatus is properly attended to, there will be no smoke." "Yes," said the man. "Well, then," replied Mr. Holdforth, "take notice and remember, that if I see any smoke coming out of the top of the chimney, you must take that as a month's notice to quit." This he found had the effect of making the man attentive to his duties; and if he managed well, and to his (Mr. Holdforth's) satisfaction, he occasionally gave him a little reward.

R. RODDA is now in LEEDS, and begs to inform the PROPRIETORS OF STEAM ENGINES, &c., in Yorkshire, Lancashire, and elsewhere, that he has REDUCED HIS PRICES, and is also furnished with numerous testimonials as to the perfect success of his plan for CONSUMING SMOKE and SAVING FUEL.—Communications, addressed to 11, Briggate, Leeds, attended to immediately.

DREDGE'S PATENT IRON BRIDGES.

THIS economical and powerful system of construction is founded upon the principles of the lever—therefore, it is adapted for the heaviest traffic on rail and other roads, and for the largest or smallest spans in all situations. It is not half so expensive as timber bridges; and, taking an average of large and small spans on the old principles of suspension, this system admits of the erection of 10 powerful bridges for one, there being so much less material and labour in their construction. The Clifton-bridge, upon this principle, could be erected for £10,000, in six months. The principle was first used by the Victoria Bridge Company, over the Avon at Bath, in 1836, in a bridge 150 feet long, and 19 wide. Afterwards, the government adopted it in five bridges in the Regent's Park; and Sir James Colquhoun, Bart., used it over the Leven, in Scotland; this bridge is 292 feet long and 20 feet wide. Another is erected at Wraysbury, near Windsor, for G. S. Harcourt, Esq., and one across the river Frome, for H. Miller, Esq. The elevation, plan, sections, and description of Mr. Harcourt's bridge is published in the "Architect, Engineer, and Surveyor," No. 36. It is 100 feet long and 17 broad, and its cost was less than the centering for a stone bridge of the same magnitude.

*** J. DREDGE will undertake the construction of bridges, and guarantee their stability; and he will take shares in any toll bridges he may erect.

Bath, March 1.

BY HER MAJESTY'S ROYAL LETTERS PATENT.

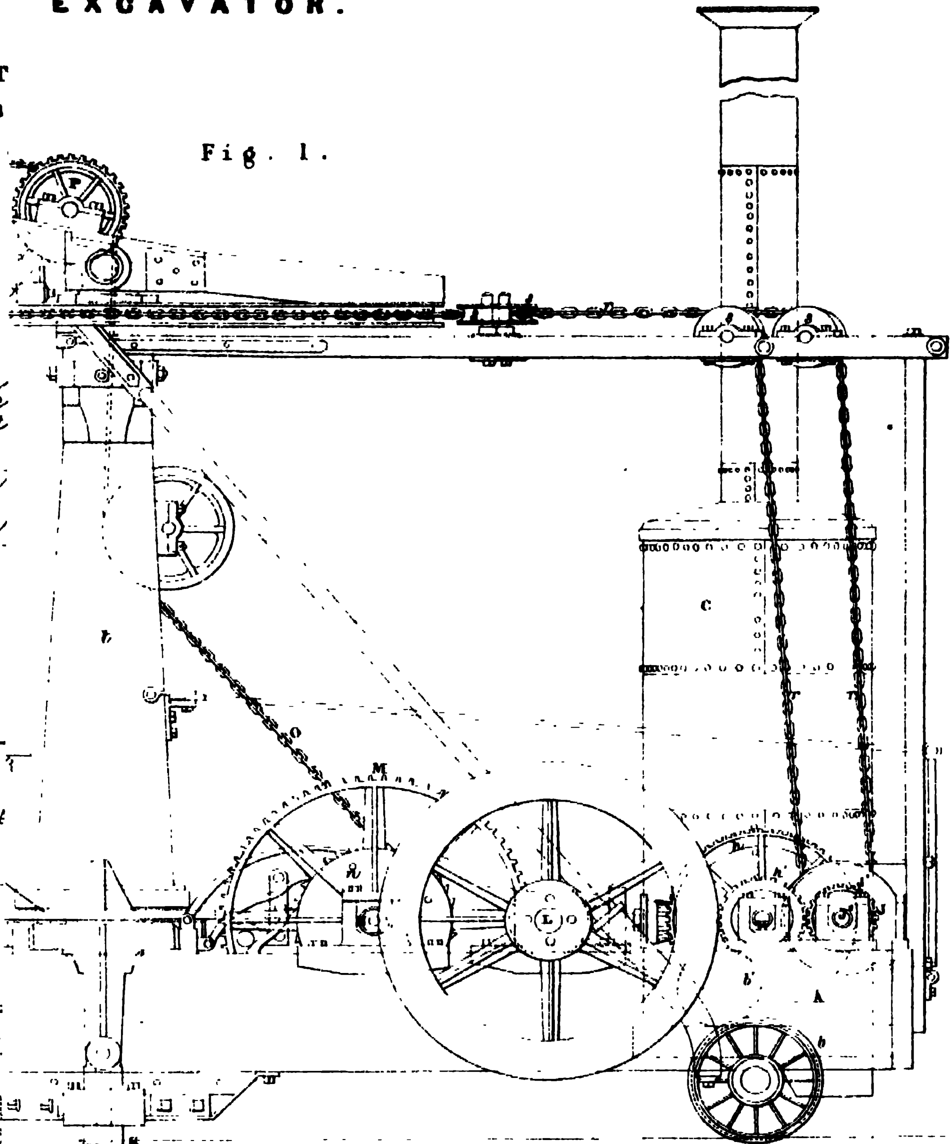
GERISH'S PATENT DOOR-SPRINGS, FOR CLOSING EVERY DESCRIPTION OF DOOR.—Manufactory, 16, East Road, Hoxton New Town.

These springs consist of parallel and rising hinges in Brass or Iron, and swing centres for doors opening both ways.

These improved spring-hinges or door-springs merit general attention, as they can be applied to any door, in every situation, without defacing the wood-work; their action is easy and noiseless, neat and not visible when the door is shut, and are made to surpass the best now in use for nearly one half the price; they allow the door to go quite back, and are not likely to get out of repair.

The Swing Centre possesses in a simple combination of power double the strength of any hitherto invented in a much smaller size, and at little more than half the expense.

LITHIC ANTI-CORROSION PAINT, long known for its durable qualities in all climates as a cheap out-door paint for covering Brick Wood, or Iron. Manufactured in Stone or Slate Colours by J. B. WHITE and SONS, Millbank Street, Westminster, Roman Cement Manufacturers.



ROOF OVER T
NEWCAS

REVERSING APPA

Fig. 3.

Fig. 2.

J.R. Jobbins. 3 Warwick Ct

THE AMERICAN STEAM EXCAVATING MACHINE. ("YANKEE GEOLOGIST.")

(With an Engraving, Plate VI.)

This machine, which is the invention of the late Mr. Ottis, of New York, is an application of steam power to the purposes of excavation and dredging; and for the former purpose, appears greatly superior to any thing which has hitherto been achieved in excavating machinery. The accompanying engraving, which has been made expressly for our *Journal*, by Mr. George Spencer, Mechanical Draughtsman, from the original working drawings in his possession, presents the principal side elevation (Fig. 1) of the machine, which brings all the working parts sufficiently into view; Fig. 2, a plan of the horse-shoe pulley and crane top; the dotted lines show the position of the lower framing or stage and boiler; Fig. 3, shows the crank shaft and gearing; Fig. 4, the main drum; Fig. 5, the main drum for working the excavator; and Fig. 6, a plan of the excavator.

The whole of the details of this machine, which are very elaborate and complete, of course cannot be attempted in an article of this nature; we will, however, describe as much of the details and its principal feature as are necessary to a proper understanding of the several movements of the machine, and then describe each of those movements separately. The machine consists of a strong horizontal wooden framing or stage A, mounted upon two pairs of railway wheels B, for locomotion, which run on temporary rails, laid down as may be required; on the one end of the stage is fixed a cylindrical boiler C, and the gearing for turning the crane round. In the middle is placed the gearing for working one of the motions of the excavator D; and, at the other end is placed the wooden crane E, in form similar to an ordinary timber crane, on the diagonal brace of which is placed a platform *f*, on which an assistant stands; and gearing U, for working another motion of the excavator D. To support the machine laterally, strong brackets or arms project on either side, the ends of which are furnished with screws to adjust the machine to the inequalities of the surface of the ground.

The excavator or shovel D, (Figs. 1 and 6,) is formed of stout boiler plate, and is firmly rivetted together; it is of a box shape, having one end open; on the lower edge are four tangs or points, which serve to penetrate and loosen the soil; the other end is hung on swivel hinges, and fastened by a spring *d*, which may be set at liberty by means of the lever and rods *a*, Fig. 1.

The machine is made to perform three distinct movements; 1st, the digging movement; 2nd, the turning movement, and 3rd, the locomotive movement.

The Digging Movement consists of two motions, one for drawing the excavator forward, and the other for driving it into the ground, both of which is done simultaneously; the first motion is performed in the following manner. On the horizontal stage A, and in front of the boiler C, is placed a small high-pressure engine, (not shown in the engraving,) the connecting rod of which acts upon the crank *c*, and gives a rotary motion to the shaft L, and with it the pinion *l*, (Fig. 3,) which works into the large wheel M, mounted on the shaft N, upon which is fixed a large channelled barrel or drum *n*, (Figs. 1 and 4,) round which the hauling chain O, is coiled; this chain passes upwards through the hollow crane post, over the indented pulley P, to a double pulley fixed at the jib head, thence round the blocks R, to which the excavator is suspended, as the chain wound up draws the excavator out of the ground both in a forward and upward direction, when driven into the ground by the second motion. This last motion is communicated by the chain traversing over the indented pulley P, to another gearing. On the axle of the indented pulley P, is fixed a bevelled wheel *v*, (Fig. 2,) which works into a similar one *v'*, (Fig. 1,) mounted on to the upper end of the oblique shaft V, on the lower end of which is a corresponding bevelled wheel *v''*, working into another *w*, fixed upon the shaft W; upon this shaft is a pinion *w'*, which takes into the large spur wheel *u'*, mounted upon the shaft U, upon which is a channelled drum *u*, round which is coiled the chain *s*, attached to the diagonal wooden arms S; on the lower end of these arms is fixed an iron yoke, to which is suspended on pivots the excavator. By this arrangement, as the main chain O, passes over the pulley P, motion is communicated to the shaft U, for the purpose of forcing downwards in a diagonal direction the arms S, and with them the excavator into the ground. A man stands upon the stage *f*, for throwing in and out of gear this apparatus, and to regulate the motion for lowering or raising the excavator.

The next motion to be described, is for the purpose of turning the crane round either to the right or to the left; this is effected by another gearing in the following manner. On the first crank shaft L, is fixed a bevelled wheel *l'*, (Fig. 3,) which works into a similar wheel *g*, mounted on to the end of a horizontal shaft G, upon which are placed loose two bevelled wheels *g' g''*, either of which can be thrown in or out of gear so as to work, as may be required, into the large bevelled wheel *h*, mounted upon the shaft H; upon this shaft is a pinion *h'*, which works into the wheel *j*, fixed on the shaft J, upon this shaft is fixed an indented pulley *j'*, round which the chain *r*, is coiled, and passes upwards over pulleys *s*, round either side of the horse shoe pulley, to the ends of which it is fixed by iron bolts; the horse shoe pulley is fixed by means of strong iron stays to the crane, and when it is made to revolve the crane jib is turned round on the stationary post *t*, either to the right or to the left as may be required, and empties the contents of the excavator into a wagon or barrow.

The Progressing Motion is effected by placing on the hind wheel axle a strong wheel, shown by a dotted circle *b*, (Fig. 1,) which communicates with a pinion *b'*, on the shaft *t*, by an intermediate pinion *b''*, as shown by a dotted circle; motion being given to the shaft H, by the bevel gearing, described in the last motion, a forward or backward motion of the machine is obtained.

We have no precise data as to the cost of the machine or the quantity of work that can be performed by it, further than a short paragraph we gave in the last November number of the *Journal*, wherein it states that the machine is capable of digging 1000 cubic yards of earth *per day*, and that a machine complete costs about 6000 dollars in America.

ROOF OF THE RIDING SCHOOL AT NEWCASTLE-ON-TYNE.

(With an Engraving; see Plate VI.)

Sir—Having expressed your intention of giving some examples of construction useful to the student, in the description of the roof of the Polytechnic Institution, Vienna, in a former number of your excellent work, I am induced to send you the enclosed sketch, on account of the similarity of construction in the two, and they being the only cases I know extant where support is obtained from the side walls of the building on a line lower than the level of the tie beam, I shall first describe the peculiarities of the Vienna roof, and then of the roof at Newcastle. The former is 56 ft. span, and formed of curvilinear ribs 12 in. square, standing on a set-off of the wall considerably below the wall plate, and the crown of the rib rising about as much again above it, the slope or pitch of the roof being made uniform with rafters of smaller scantling. The ribs are cut out to the sweep of the curve, and are not laminar ribs, by which mode much additional stiffness is acquired. It is evident the arch is the principle of construction. The covering is copper, the weight being about 100 lb. per square, whilst tiles are 650 lb. weight per square. The annexed engraving exhibits the roof constructed over the circus or riding school at Newcastle, erected in 1789, under the superintendence of Mr. David Stephenson, architect, who was a resident and practised in Newcastle; he was the architect of the Theatre Royal and All Saints' Church, and architect to His Grace the Duke of Northumberland, &c. The span of the roof is 64 feet in clear of the walls, the length about 76 ft., and the height of the room from the floor to the crown of the arch, or horizonal beam at the foot of king post, 30 ft. The tie beams and principals are 12 ft. by 6 ft. placed 10½ ft. apart. The struts from king post 8 ft. by 8 ft.

The king post, straining collar (the horizontal beam) and struts from side walls, 12 ft. by 10 ft. in two thicknesses and bolted together. The purlins are 10 ft. by 6 ft. and about 9 ft. apart, being four in number on each side of the span. The common rafters are 5 ft. by 2 in. and are placed 3 ft. apart from centre to centre. The ridge 12 in. by 2 in.

By a comparison of the two roofs, the simplicity of the Newcastle roof over that with curved ribs, is at once apparent; no wall plates are used at the foot of the struts on the side walls, and at the level of the eaves; a pole plate and vertical posts at the foot of each rafter is dispensed with. The braces are prolonged to the king post, and act both as a tie beam and a counter strut to the main struts or portion of the curb roof, resting on the side walls at a level lower than the eaves. The principle of this roof is that of the common curb roof, as by inspection of the sketch it will be seen that the strongest scantlings are so arranged. On a few of the couples or pairs of principals a curved rib is affixed to the tie beam and strut, so as to give the roof a curvilinear form; but as it is dispensed with in some, it shows that it is not essential to the stability of the structure.

I am, Sir,
St. Ann's, Newcastle-on-Tyne. Your obedient servant,
O. T.

ON REVERSING LOCOMOTIVE ENGINES.

(With an Engraving, see Plate VI.)

SIR—Having by chance fallen in with a number of your *Journal*, (the number for February, 1842,) I perceive in it a design for reversing locomotive engines, signed H. and P., upon which, with your permission, I beg to make a few remarks, as the principle of it is similar to one of my own.

In the latter part of the year 1842, I designed two plans for reversing, the reversing valve being in the one case a slide, and in the other a four way cock; the former of these was published in a contemporary journal,[1] but having been forestalled in my design for the latter, it was never published: the two grand objections to be contended against in these designs, were, the pressure of the steam against the under side of the slide when reversed, and the (as yet) impossibility of obtaining *double lead*; to obviate the former of these, I proposed the design enclosed, which is much more simple and less complex than H. and P.'s plan. In the first place, the use of the four way cock for changing the direction of the steam, does away with the necessity of filling up the smoke box with the piston valve, and is besides, less expensive; secondly, the connexions between the pistons in the *working* valve box, are mere rods, instead of the pipes used by H. and P.; thirdly, a less quantity of steam pipes are required, as instead of *two* sets of pipes between the reversing and working valves, I use three short pipes crossing the bottom of the smoke box, connecting the *centre* of each box, and the *ends* individually.

For explanation of my design, allow me to refer you to the sketches enclosed.—See plate VI.

A, is the steam pipe, which conveys the steam from the top of the dome H, through the top of the smoke box, to the four way cock B, from whence the pipes C and D, take it to the valve boxes, the pipe C, connects the cock with the *ends* of each valve box, or that part on the *outside* of the working pistons in it, and the pipe D, connects it with the centres of each box or that part of the box *between* the pistons, in Fig. 1; the four way cock (shown in section) is so set as to allow the steam to proceed along the pipe D, to the *centres* of the valve boxes, while the waste escapes up the pipe C, from the *ends* of them, into the blast pipe; there are three pipes between the valve boxes E E, one of which is shown at F; the section of the valve box in Fig. 2, shows the positions of these pipes, which enter the box at K, K, K', the pipe D, being connected to the box opposite K', and thence proceeding across to the other box, and the pipe C, being connected opposite to the passages K K, and thence crossing to the box on this side; the mode of action of the valve is so simple, as not to require any explanation further than that the pressure is balanced as effectually, as in H. and P.'s plan; the dotted lines show the position of the four way cock plug when reversed. Having, as I hope, fully described by own plan, will you allow me to say a few words respecting H. and P.'s mode of obtaining *double lead*, may I ask them if this plan has ever been tried, and if so, if it was found to answer the inventors' expectations, as it is my firm belief, that if it had been tried before its appearance in your pages, it never would have made that appearance. The mode of working two valves with one eccentric, is an exceedingly ingenious one, and as far as I am aware, is quite an original idea; but it will not require much demonstration to show the futility of the mode of obtaining lead, by the use of the circular slots; the mistake into which H. and P. seem to have fallen, is by no means a solitary instance of premature conclusions, as witness the propositions contained in the 3rd and 4th Vols. London *Mechanic's Magazine*. I will take the same position of the eccentric, as given by H. and P., thus in Fig. 3, let the perpendicular dotted line represent the position of the crank, being at half stroke, then (lead being given) the position of the pin on the lever for working the valve, will be at D; but suppose the steam passages to be reversed, the crank, carrying with it the eccentric ring, will revolve in a contrary direction, and the pin D, will not be moved until the crank arrives at C, as shown in Fig. 1, consequently the valve will be just so much in arrear as it had lead in the former position, as the valve lever will not be in the proper position for giving lead until the crank arrives at C, whereas it ought to be in the same position as in Fig. 3, which is at half stroke. It is not, perhaps, generally understood, that the real position of the valve to obtain lead requires *no alteration*, when reversed in this manner, but the relative position of the valve to the motion of the eccentric must be altered.

I am, yours, obediently,
42, *Great Avenham Street, Preston,* WILLIAM JOHNSON.
April 7, 1843.

[1] The Practical Mechanic and Engineer's Magazine.

VELOCITY OF WATER DOWN VERTICAL PIPES.

SIR—I have attentively perused the several articles which have lately appeared in your scientific *Journal*, on the velocity of water down vertical pipes under certain conditions; but I by no means agree with your correspondent T. F....n, who asserts, that the velocity of water down a vertical pipe 16 feet long, under these conditions, will be 32 feet per second. Nor does it appear to me, that the mutual cohesion between the several layers or particles of water in the pipe, is a force sufficient of itself, to account for the solidity of the issuing stream, as stated in a late number of your *Journal*.—The following is my humble opinion on this interesting subject.—

First, as to the *velocity* of water down a vertical pipe 16 feet long the top of the pipe being considered to be always covered with water.—

The following table extracted from "Grier's Mechanic's Dictionary," exhibits the natural velocity due to a body, after having fallen through the undermentioned distances; and will be found useful as a reference in the following remarks.—

Space through which the body falls in feet.	Velocity acquired at the end of the time. feet per second.	Space through which the body falls in feet.	Velocity acquired at the end of the time. feet per second.
1	7·3103	10	24·7647
2	11·0637	11	25·9628
3	13·4165	12	27·1232
4	15·6562	13	28·2264
5	17·2903	14	29·9786
6	19·1725	15	30·3601
7	20·7078	16	31·3176
8	32·1435	17	32·2833
9	23·4890	18	33·1975

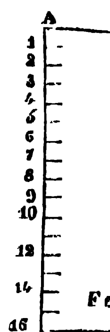
It appears from this table, which is founded on the well-known law, that "the velocity acquired by a body falling from rest in a free space, is as the square root of the space fallen through," that the velocity of

water at the end of the 1st ft. is 7·3103 ft. per second, (and not 4 ft. as stated by your correspondent T. F....n); at the end of the 4th ft. it is 15·6562: and at the 16th ft. 31·3176 ft. per second: or, in round numbers, 8, 16, and 32 ft. per second. If then the motion of the whole of this column is uniform, whence has the power been obtained to increase the velocity of water at the end of the first foot, from 8 feet per second, to, say, 16 or 32 feet per second? Doubtless from the superior velocity due to the lower parts of the water in the pipe. If this is the case, then must the natural velocity due to the lower portions of the water be diminished; for nobody when in motion can impart any motion to another body at rest, or increase the velocity of that body if in motion, without a diminution of its own velocity, in proportion to the respective momenta of the two bodies.—Therefore, it is not possible that the water at the end of the 16 feet pipe, whose natural velocity is 32 feet per second, can, after it has imparted a quicker motion to the higher portions of water, still possess the same velocity that it would have had, if it had not parted with a portion of that velocity, in increasing the velocity of the upper parts of this column. Consequently, it follows, that the velocity of the water issuing from the pipe must, (if the stream fills the pipe and flows uniformly through it), be diminished, and therefore be less than 32 feet per second.

Next, as to the cause of the *solidity* of the issuing stream.—Let us first consider the phenomena of a stream of any liquids falling from a height, but not down the interior of a pipe; or even a continuous stream of leaden bullets. For a short distance we perceive the stream solid, till the increased velocity of the lower parts as they descend causes them to leave those immediately above them, air filling up the intervening space, and thus the solidity of the stream is broken. Now let us turn to the pipe, and we see, by the above table, that the natural velocity of a layer of water which has fallen one foot, is 7·3103 feet per second, and of another which has fallen two feet, 11·0637 feet per second; why then does not this lower portion fall faster than the higher one, and separate from it, and thus break the solidity of the stream? Simply because if it did so, there would be a vacuum between these two portions of water, because the sides of the pipe are impervious to the air; and as the atmosphere is pressing on the water at the top and bottom of the pipe with a pressure, say, of 14 pounds per square inch, these portions are kept together by this pressure; for no sooner does an under stratum of water try, as it were, to leave the stratum above it, and form a vacuum, than the presure of the atmosphere at the top of the pipe is brought into action, and the velocity of the upper stratum increased; while at the same time a portion of the atmospheric pressure, being by the same tendency removed from the upper surface of the lower stratum, the full pressure of the atmosphere is exerted upwards at the base, and the velocity of this lower stratum is consequently diminished. This certainly appears to account more satisfactorily for the solidity of the stream, than the force of cohesion; for this force must have the same influence over the particles of water whether they are in the inside or on the outside of the pipe.—As a proof, that when water is descending in the interior of a pipe, which is continually covered with water on the top, the atmosphere has a tendency to rush in through the sides. I need only mention the wellknown fact, that if in a pipe under these circumstances there happen to be a crack, or a hole bored through the sides, the air immediately rushes in, and the solidity of the stream is destroyed.

Lastly, to determine the *actual velocity* of this continuous column of water.—Let us suppose the water in the pipe composed of an immense number of laminæ, each of the thickness of a particle or atom of water, and consequently of the same thickness and weight; and let us take under our consideration the case of any two of these contiguous laminæ, and suppose that the velocity due to the higher one is, say, one inch per second; and the velocity due to the lower one is, say, two inches per second. Then if these two laminæ, when moving with these velocities, be at the same instant connected by the pressure of the atmosphere, or otherwise, so that the one cannot move on without the others moving along with it, it is evident, since the quantity of matter in each is the same, that the resultant velocity of the two will be one half of the sum of their original velocities, or one and a half inches per second. If then we could obtain the natural velocities due to each respective laminæ, the average would be the result and velocity for the whole column. On taking the average of initial and final velocities due to the water at the end of each successive two feet, from the foregoing table, and then dividing their sum by 8, we have 20·6077 feet as the average velocity of the whole column. And if by approximating rather more closely to the system of atomic laminæ, we take the average of the initial and final velocities due to each *foot* of water, and divide the sum by 16, the resultant is 20·7265 feet per second.

Again, since "The velocity acquired by a body falling from rest in free space is as the square-root of the space fallen through," the space varies as the square of the velocity.—If then, we take the spaces fallen through at the termination of each foot in the 16 feet, (as in the first column of the above table) as abscissa, and the respective velocities (as in the second column) as ordinates, the resultant curve will be a parabola similar to the figure below.—



Let us suppose the line AB, represented in this figure 16 feet, or the space fallen through, to be divided into an almost infinite number of parts equal to the number of atomic laminæ in the column of water; then if we could find the length of the several ordinates at those points, and divide the length of the whole by their sum, the result would be the average length of all the ordinates, and consequently the average velocity. This can be done by finding a rectangle whose area is equal to the area of the parabola, and one of whose sides is equal to AB.—Now, $\frac{2}{3}\times$ abscissa AB $\times$ ordinate BC $=$ area of the parabola $= \frac{2}{3}\times 16\times 31\cdot3176 = 334\cdot0544$ ft. Therefore $\frac{334\cdot0544}{16} = \frac{\frac{2}{3}\times 16\times 31\cdot3176}{16} = 20\cdot8784$; consequently the two sides of this rectangle are 16 feet and 20·8784 feet, of which 16 feet represents the space fallen through and 20·8784 feet the average of all the ordinates, and consequently the average velocity. 20·8784 feet therefore is the average of the natural velocities due to the several atomic laminæ composing this column of water. Again, it is evident, that since the abscissa AB (or 16 feet), enters both into the numerator and denominator of the fraction representing the average velocity, it may be eliminated altogether; and the expression then becomes $\frac{2}{3}\times 31\cdot3176$; or, "The velocity of water descending the interior of a pipe 16 feet long, is equal to $\frac{2}{3}$ of the natural velocity due to a body, after it has fallen through a distance, in free space, equal to the length of the pipe."

I. T——N.

Shropshire Lunatic Asylum.—We understand Messrs. Cooper, builders, of this town, have entered into contract with the magistrates of the county of Salop, for the erection of a Lunatic Asylum for that county. The building is from a design by Messrs. Scott and Moffatt, of London, in the Elizabethan style. The extent of the front 280 feet, and arching 170 feet. The plan is in the shape of the letter H. The first part of the building will cost £11,000.—*Derby Reporter.*

THE AERIAL TRANSIT MACHINE.

Analysis of the projected Aerial Transit Machine, and of the principles involved in its construction and employment.

From the earliest period of antiquity the desire to navigate the skies has ever formed one of the most prominent passions of the human breast. In the commencement, ere man had acquired sufficient skill to be able to submit his ideas to the test of experiment, the indulgence of this passion could only display itself in vain aspirations or the wild effusions of an unrestrained and romantic imagination. To this source may be traced some of the most elaborate conceptions of the Heathen poets; the fables of Dædalus and Icarus, of Perseus and Bellerophon, the air-borne car of Medea, the winged heel of Mercury, the Harpy, Chimæra, Pegasus, and many others equally fanciful and absurd, which characterise the history and mythology of the remoter ages.

As the world, however, advanced, and some insight began to be obtained into the nature and constitution of the surrounding atmosphere, the reveries of the poet gradually gave way to those of the philosopher, and men at length bethought themselves of imitating what, before, they had been contented to admire. Thenceforward to the present period, all that human ingenuity could devise, has been constantly arrayed in the pursuit of this favourite object, and the empire of the skies has never ceased to be contested with an energy and zeal almost as great as ever was displayed in the subjugation of the earth.

Of the schemes to which this interesting inquiry has given rise, some, and those among the earliest, professed to operate after the manner of birds, by the mechanical reaction of wings against the subjacent air. Such was the nature of the plans of Roger Bacon, Fleyder, and others, too numerous to mention, some of whom attested the insufficiency of their devices at the expense of their limbs, and even of their lives, while some, more cautious, only projected experiments, which they left to others to perform.

To schemes of this description, which may be termed the *mechanical*, succeeded others based upon the physical or chemical principles of the atmosphere, real or presumed. Of this nature were the designs of Bishop Wilkins, and the Jesuit Lana, and that (more absurd than either) which, proceeding upon the supposition that the particles constituting the upper strata of the ætherial mass were of a more buoyant consistency than those below them, proposed to accomplish its object by enclosing in a proper vessel a portion of air abstracted from the very regions which itself was to offer the only means of approaching.

It would occupy more space than we could here afford, and serve moreover no beneficial purpose, were we to attempt to recount, much less to describe, all the schemes that have been successively proposed, dilated upon, tried, found wanting, and subsequently abandoned, in the prosecution of this interesting design. Suffice it to say that in the one material point, namely, the procuring an elevation into the bosom of the air, they all proved equally inefficacious, until the discovery of the balloon by the brothers Montgolfier in the year 1782. Two instances, indeed, and but two, are authentically recorded, in which the attempt to fly by mechanical means has been attended with partial success—that of the Marquis de Bacqueville, who, in the year 1742, accomplished a flight partly across the Seine in Paris, and that of an individual of the name of Degen, who, at Vienna, some years ago, succeeded in raising himself to a height of about 50 feet by means of the alternate reaction of large surfaces shaped after the fashion of an umbrella, and worked by the exercise of the arms and legs. These, however, were but the more splendid failures; and the prospects of aerial navigation may be said to have been at the very lowest ebb when the ingenious discovery of M. M. Montgolfier, with the subsequent improvements of M. Charles, in which hydrogen gas was made to take the place of heated air, revived the drooping spirit of enterprise with the promise of a more easy triumph in the fields of air. Abandoning the former mode of operating, for the purpose of obtaining an ascent, men now directed their attention entirely to the means of controlling the motions of the machine, by the intervention of which that, apparently the most arduous and perplexing condition of atmospheric transport, had been so suddenly and unexpectedly accomplished.

In this, however, as in the more independent processes of flight by mere mechanical reaction, human ingenuity was doomed to be defeated. With all the flattering prospects of success which an almost unlimited power of support appeared to hold out, not only was there no commensurate progress in the essential object of securing a definite direction, but even greater difficulties appeared upon further acquaintance to stand in the way of aerial guidance by means of the balloon, than were apprehended, before that instrument had brought men into a more practical acquaintance with the character and conditions of the element with which they had to contend. The magnitude of the forces developed, owing to the necessary bulk of the machine, seemed to deride all attempts at control, while at the same time the expenses attending its construction and employment, imposed a limitation upon the experiments, by means of which alone these obstacles could be expected, if ever, to be overcome. Under these accumulated and, perhaps, insurmountable difficulties, the balloon gradually ceased to be regarded as an object of scientific interest, and at length shared the fate of all other discarded favourites, in a neglect as inconsiderate as it had formerly been courted and admired.

After a period of excitement, a state of lethargy is no uncommon result; and accordingly when the first burst of admiration and wonderment had subsided, and a succession of failures had begun to characterise the new art with something like a tinge of absurdity, the public gradually settled down into a condition of apathy and disregard in respect of aerial navigation, even the more profound from the greatness of the disappointment to which they had so recently been subjected. Occasionally, indeed, the rumour of some new improvement in the art of "flying made easy," more plausible or presumptuous than the rest, would startle them from their propriety, and, for a while overcoming their antipathy to the balloon, awaken a languid spirit of speculation, in which the dread of disappointment could plainly be seen predominating over the feebler expectations of success. These, however, were but temporary excitements, which died away as soon as they were felt, and the subject appeared to have been almost entirely forgotten, except by a few of the most ardent cultivators of the art, when the announcement of a *really new* project, totally unlike any that had gone before, and repudiating all connexion with the obnoxious instrument by which they had been so often before deluded, has again roused all their sympathies, and produced a fever of expectation which a month of cool reflection has not yet been able to allay.

The first communication of this project in a tangible form, having taken place since the publication of our last number,[1] we were precluded from giving it that notice at the time which we would otherwise have bestowed upon it; not only as in itself meriting investigation, but in consideration of the intense interest and divided opinions it had certainly excited throughout no small nor uneducated portion of the community. Ushered in with a somewhat more than ordinary degree of pretension, backed by reference to experiments of a most flattering description with models, and, to crown all, stamped, as it were, with the authority of a bill in Parliament, it not only justifies but imperatively calls for an inquiry which, to be available, must be equally searching and exact. It is of no use to regard a scheme of such complicated contrivance and involving such recondite principles, in a superficial manner or in a general point of view. The mere fact of a principle being correct is no proof of the practicability of a scheme which is founded upon it; and if the success of a *model* were conclusive in respect of the object it is intended to represent, neither would Mr. Cocking have perished in the descent with his parachute, nor would this very question of aerial navigation have remained undetermined to the present day.[2] In fact the working of

[1] The public were first made acquainted with the details of Mr Henson's patent through the plans and descriptions which appeared in the weekly journals of that rather ominous date, the 1st of April.

[2] It is well known that Mr. Cocking had spent upwards of 20 years in framing and improving models of the machine in which he afterwards lost

a model determines nothing that cannot as well be determined without it—the correctness of the principle, which is the proper subject of mathematical research. With regard to the possibility of its construction upon the great scale it would determine nothing, even if it were, which in this case it is absolutely impossible it should be, in the strict sense of the word, a perfect model, observing all the proportions of strength, weight, bulk, power and dimensions as they will appear in the real machine with reference to which they are contrived. The only true and satisfactory mode of arriving at any thing like a correct conclusion respecting the efficiency of the machine in question, or any other of the like character, is by a critical examination of its parts severally and with reference to each other, which is the course we intend to pursue on the present occasion. To enable us to do this the more intelligibly, we will begin by describing in a few words what Mr. Henson's machine is, and what is the principle upon which it is intended to act, so far as they can be collected from the statements in the public press. In general terms, then, Mr. Henson's machine may be described as an horizontally extended plane, 150 feet in length and 30 in breadth, (consequently containing an area of 4,500 square feet) across which, close beneath and in the centre, is suspended a

ERRATUM.

Page 151, col. 2, line 41, for *"the cube of the sine of the angles of impact,"* read *"the square of the sine into the cosine, &c."* which latter quantity, the angle being small, may here be safely disregarded. This leads to the necessity for an alteration in the appended figures, which should be rendered thus: "As 1^2 : ·05^2 = ·0025 : : 3000 : 7·5 = the absolute impulse in pounds upon the inclined plane, at the rate of 12 miles an hour;" and "As $\sqrt{7{\cdot}5}$ = 2·74 : $\sqrt{3000}$ = 55 : 12 : 240 = the number of miles per hour necessary to accomplish the support of the machine under the conditions of the case presumed."

The same correction requires to be extended to the calculation of the allowances for the deviation from mean pressure in the next paragraph, which should stand thus: "As $\sqrt{3}$ = 1·7 : $\sqrt{4}$: : 240 : 280 = the actual number of miles per hour the machine must accomplish to enable it to effectuate the prescribed resistance in the attenuated medium to which it must be prepared to ascend."

accomplish it sufficiently ...

upon it at an angle inclined to the horizon, whereby a part of the force generated by its opposition becomes resolved in a direction opposed to its descent; and the merit of it consists in this,—that a less degree of force is required to produce this progressive motion than that which the actual weight of the machine would require for its support. A familiar mode of illustrating this has been adopted by Sir George Cayley, in the *Mechanic's Magazine* for the first of April. It proceeds upon an analogy with the suspension of spherical substances upon an inclined plane, and cannot be better explained, as far as it goes, than in his own words. "Suppose A B to represent an inclined plane,



rising one foot in ten; it is well known that if the ball F weighed 100lb., a force of 10lb. applied horizontally would sustain it from rolling back. Conceive the same line A B to represent, also, the section of a large surface, like the sail of a ship, and that C G represents a cord by which it is sustained from being driven back by a horizontal wind in the adverse direction. If the sail contains 100 square feet of surface, and the wind has sufficient power to press with one pound to the foot, 100lb. weight will be supported, and the tension on the cord will be only 10lb. It is the same thing whether the wind thus blows against the sail, or the sail be driven with equal velocity horizontally in calm air; the 10lb. propelling power will still sustain the 100lb. in the air." It only remains to observe in what manner it effects this; namely, by producing such a rate of motion in the inclined plane as, at the given angle, would generate a pressure of one pound to the square foot.

Now to apply this to the case of Mr. Henson's machine. In the first place, the area being 4500 square feet, and the weight (taking it according to the statements in the public prints) being 3000 lb. supposing the same angle of inclination to be observed as in the foregoing illustration (that is to say, one in ten) if the wind move at a rate sufficient to generate a pressure equal to two-thirds of a pound upon the square foot, the resistance to its horizontal progress, and consequently ... would require to compete with that resistance, would be ...ght, or 300 lb. If, instead of an angle of ... substituted an inclination of one in twenty ...arly in the ratio observed by birds in their ...re consistent with the analogy Mr. Henson ...aintaining) the same result will be obtained ...esistance of 150 lb.; and accordingly it is ...we shall proceed, in the next place, to in... the machine must be propelled in order to ...istance.

...e here have to deal with is simply, "having ... surface at a given angle of inclination, to ... that pressure is developed;" and the so... ...onsideration of the rate corresponding to ...lane would experience if perpendicularly ...

... readers with entering into the details of the ...io of the forces generated by inclined planes ...s been determined; but, content with refer... of these interesting problems to Whewell's Treatise ... or indeed any other works of good repute upon the same subject), proceed at once to observe that the resistance experienced by an inclined plane in passing through the air with a given velocity, varies as the cube of the sine of the angle of impact; and that, consequently, whatever be the ratio which this number bears to the cube of radius (the sine of the angle of 90 degrees), the same will be the ratio of the resistance it will experience at the angle assumed, to that which it would experience at the same rate of motion if perpendicularly encountered.

Now the velocity under which the plane in question, containing an area of 4500 square feet, would develop the prescribed amount of resistance, namely 3000 lb. by perpendicular impact (being at the rate of two-thirds of a pound per square foot) is, according to the tables of Messrs. Rouse and Smeaton, founded upon actual experiment, about 12 miles an hour. The angle of inclination at which we have agreed to dispose the suspending plane, being one in twenty, may be considered with sufficient accuracy for practical purposes, as an angle of 3 degrees, the sine of which (radius being estimated at 1) is ·05 As therefore 1^3 = 1 : ·05^3 = ·000125 : : 3000 : .375 = the resistance on the inclined plane at the rate of 12 miles an hour; and the resistance increasing as the squares of the velocities and consequently the velocities following the ratio of the square roots of the resistance, as $\sqrt{{\cdot}375}$ = ·6 : $\sqrt{3000}$=55 : : 12 : 1100, the number of miles per hour representing the rate of the inclined plane required to support it, in conformity with the conditions described.

The consideration of some of these conditions will, however, show that this rate of motion, and, consequently, the amount of force by which we have presumed it to be generated, is far from sufficient to

his life; and the public will not yet have forgotten the pleasing experiments with Mr. Green's model of the balloon at the Polytechnic Institution last year, in which the practicability of controlling its course by mechanical reaction was so interestingly illustrated.

* It is not our desire to detract from the merits of any individual who seeks by his ingenuity to extend the limits of our attainments in art or science; but a regard to truth obliges us to observe that the idea of obtaining an ascension by means of the inclined plane is not original or peculiar to Mr. Henson's project; being in fact the mode to which all those who of late years have thought to effectuate an aerial navigation by mere mechanical reaction, have looked for the solution of this interesting question. In the number of the *Mechanic's Magazine*, for the 25th April, 1829, is a sketch of an apparatus constructed entirely upon the same principle, and many more might be referred to of an earlier as well as a more modern date.

satisfy the exigencies of the case. In the first place, the data upon which the calculations of the resistance of the atmosphere have been grounded, are deduced from a consideration of the density under little more than mean pressure, equivalent to the support of a column of mercury 30 inches in height; whereas it is well known that it frequently, or at all events occasionally, falls to an extent of nearly two inches, implying a reduction in the density equal to $\frac{1}{15}$th of its whole amount. In respect of this condition alone, therefore, 25 miles per hour would have to be added to the above to enable the machine to maintain its pristine elevation, *but slightly removed above the surface of the earth.* But the mere retention of this elevation, without the power of augmenting it at will, within certain limits, would be evidently very insufficient for the purposes of a perfect aerial navigation. It is unnecessary to dwell upon the many occasions which the inequalities of the earth's surface would present, in the extancy of the objects upon it, both natural and artificial, when it would be necessary to assume a higher course in order to escape a collision. Some of these, it is true, could be *gone round*, and thus avoided, instead of being surmounted. But there is still a great variation in the prominence or altitude of the plains and large ranges of mountain country, which could not be so dealt with; and in respect of these, a considerable allowance must be made in the powers of the machine. No part, for instance, of the Alps or Pyrenees, extending entirely across Europe, could be traversed under an elevation of 8000 feet, and without the power of accomplishing this, the use of the machine would be restricted to a very small portion of our own continent, or forced to make a *detour* equal in some cases to perhaps the entire extent of its intended route. Now for every 1200 feet of elevation, in the beginning of the scale, a reduction of one inch may be counted upon in the height of the barometrical column; so that if we only presume an elevation of 8000 feet, we shall have imposed upon the aerial machine an obligation of conducting her operations in an atmosphere the density of which will have been reduced to an extent indicated by a fall of the barometer to 23 inches; from which, if we further subtract the amount of the variation from mean pressure previously mentioned, we shall have a density of the medium only three-fourths of that, upon the hypothesis of which her former velocity had been assigned. Now the pressure, according to the first law of resistances, being directly as the densities of the media, by this condition, therefore, we shall have incurred a fresh obligation of speed, following the ratio of the square roots of the densities, the total amount of which will be determined by the rule of three proportion; thus, as $\surd 3 : \surd 4 :: 1100 =$ the number of miles per hour necessary to accomplish the required resistance under mean pressure : 1246 miles (nearly), — the rate at which the machine must be impelled to enable it to effectuate the same amount of resistance under the reduced pressure to which, in its elevation, we have seen it will have to be exposed. And this augmented velocity, be it observed, arising solely out of the reduction in the density of the medium, will be maintainable by the application of the same effectual force, namely 150 lb., by which the first assigned velocity was shown to be determined.

Hitherto we have regarded the qualifications of the machine in respect of rate and force apart from any considerations but the necessity of securing an elevation in the air. But a velocity of 50 miles an hour, however it might satisfy the conditions of support, would evidently be insufficient to realize that progress independent of the action of the winds which is necessary to the constitution of a *certain* and *serviceable* mode of transport. For this purpose, something more than the actual rate of the winds is the least amount of speed which could be considered sufficient to meet the exigencies of the case. Now, the average rate of the winds, in this climate at least, may be stated to be about 25 miles an hour. This we are enabled to determine, not from the observations of the meteorologist alone, but also, (and what is more to the point because founded upon experience in that part of the atmosphere with which we have more especially to do) from a consideration of the average rate of Mr. Green's aerial excursions,* deduced from a series of 249 voyages, executed generally, of course, in the most favourable periods of the year. From this we learn that 25 miles an hour is the mean rate at which a body floating in the air may expect to be transported; to this we must add considerably more to secure a balance in favour of the machine, for which an additional amount of force must be provided over the amount assigned for its support.

The determination of this new quantity however depends entirely upon data with which we have not been furnished. In the calculations which we have hitherto made, we have regarded the machine as a mathematical plane, altogether unproductive of any resistance except what contributes to the counteraction of its descent. This, however, it is scarcely necessary to observe, is an hypothesis which is not correct in fact; and the distinction will be seen to be of serious importance, when we consider that, for every square foot of plane surface made up of all parts and projections that receive the direct impact of the air, the machine experiences, at the rate of 100 miles an hour, a resistance equal to about 50 lb.; so that if we only suppose it to present an additional extent of resisting surface equivalent to a plane of 10 square feet, it will encounter an opposition equal to four times what has already been assigned to it, and consequently involve a necessity for four times the amount of force which was previously required.

Now the conditions of *force* in the first instance prescribed might have been considerably (almost indeed, indefinitely) reduced by increasing the superficial contents of the suspending plane. For instance, if instead of an area of 4500 square feet, it had presented a surface of double the extent, (which it could have been made to do, by doubling the breadth or adopting another form, without augmenting the difficulties of construction,) the same degree of elevation would have been obtained with less than half the force; as will be evident if we consider that while the resistance follows the ratio of the dimensions, the dimensions observe the ratio of the squares of the velocities: so that in this point of view the suspending plane of Mr. Henson's machine may be shown to be contrived without due regard to the economy of the forces by which it is upheld.

But there is another purpose which the suspending plane is required to fulfil, and which must be taken into consideration in adjudicating upon the plan before us. It is to be recollected that this elevation is maintained only by the exercise of a progressive motion, and that in order to effectuate a safe descent this motion must be suspended. It is scarcely necessary to observe that a projectile force, however modified it might be, is quite incompatible with the preservation of human life under any mode of accomplishing a descent which could be proposed; and that unless it can be accomplished by the independent resistance of the suspending plane, it can never be safely accomplished at all. There are two modes by which the actual rate of descent may indifferently be ascertained. To one of these modes, which is an inference from the pressure exerted by the air in motion at different degrees of velocity, we have already adverted in determining the speed at which, under perpendicular pressure, the plane in question would generate a resistance equal to its weight. From this we have seen that a rate of 12 miles an hour is exactly answerable to the conditions of the case; being that at which a plane surface develops the resistance assignable to Mr. Henson's machine, namely, two thirds of a pound to the square foot; and accordingly that number expresses the rate at which the machine in question would descend through the air if left of itself to fall.

In addition to this method, Dr. Hutton has left us a formula by which the same may be calculated with sufficient accuracy for practical purposes, and which it will be seen leads to a result confirmative of the approximate correctness of our conclusions. Taking W to represent the weight and D the diameter of a circular plane of the given area, $\frac{26}{D}\surd W$ gives the number of

* "The total distance which Mr. Green accomplished in the course of his first 200 aerial excursions, a very accurate computation enables him to fix at 6000 miles; and the time consumed in the performance at 240 hours. The former of these two quantitise divided by the latter gives the result above." *Areanoutica*, page 298.

feet per second which constitutes the terminal velocity of the falling body. In the present case, D being equal to 76 feet and the weight 3000 lb., we have $\frac{26}{76}\sqrt{3000} = \frac{26}{76} \times 55 = 19$ feet nearly in a second, or somewhat less than 13 miles an hour. It is unnecessary to point out the insufficiency of this retardation to effectuate the safe descent of human beings. It will serve to give some idea of the force and necessary consequence of such a precipitation, merely to suggest the shock that would be experienced by an individual if he were to be launched unprotectedly against a solid wall from the top of a vehicle travelling continuously at the rate of 12 miles an hour. In this respect therefore, the suspending plane of Mr. Henson's machine is particularly deficient. It has been calculated, and no doubt upon good grounds, that the least rate of descent which consists with human safety is 3 miles an hour; and though if we could always command the conditions of the descent so as to alight upon our legs, we might be able to sustain a greater concussion without peril, yet, as a general principle, and more particularly with reference to the circumstances of the case before us, we shall not be too exigent in requiring a power of retarding the descent within double these limits. Now the resistance upon a square foot of plane surface in motion through the air at the rate of 6 miles an hour, is ·176 of a pound, and the whole weight to be sustained being 3000 lb., we shall have an apportionment of surface to weight in the ratio of about 6 feet to the pound, amounting in the aggregate to an area of 18,000 square feet, or 4 times the actual size of Mr. Henson's plane. The correctness of this estimate may be readily verified by reference to Dr. Hutton's formula before adduced, by which it will be seen, that such is the rate at which such a plane so loaded would make its descent through the air.

But for the continuation of these investigations we must refer the reader to our next number.

THE CAUSES WHICH HAVE ENNOBLED ARCHITECTURE.

By Frederick Lush, Associate of the Institute of British Architects.

An art which depends upon the cultivated powers of the human mind must be necessarily slow in arriving at perfection. As it had its origin in some simple want, its primary object is to satisfy the necessaries and promote the happiness of man, in whatever condition he may be placed. The end of architecture, like all other works of imagination and taste, is to give pleasure, but it will fail doing so, when this principle is lost sight of. On this account the expression of use and fitness has been considered by all writers on art, as the chief element of beauty; and we expect to find that the buildings of different nations will be indicative, not only of their peculiar habits and customs, but also of the country in which their several styles originated. There is no occasion to speculate on the influence which scenery and climate exert upon the mind, and how they consequently operate upon all the productions of man. The difference of opinion and degree in which the sentiment of the beautiful has unfolded itself in various parts of the globe, plainly shows that the temperature and circumstances of one clime are more congenial for the practice of this noble art than another. Nature scattered her beauties on the soil of the Greeks with a liberal hand, and as they were quick to discern and appreciate them, they were wrought by the sculptor on their temples and monuments. The embellishments with which they were thus supplied, were in harmony with surrounding objects; and we cease to wonder at the fascinating works which emanated from this favoured people, when we see that the finest models in nature were ever present to their imagination. Among these resources, none gave them, perhaps, greater power of conceiving what was beautiful, than the various passions, attitudes and proportions, which they had the opportunity of studying during the exercises of their athletæ. Here was exhibited to their astonished gaze the wonderful structure of the human frame; and it is when contemplating the character which man sustains in the varied scenes of life, when watching the many ways in which his hands are employed for advancing the good of his fellow-creatures, or, when he breathes and speaks to us out of the marble or canvass, that we recall to our memory the fine soliloquy of Hamlet. "What a piece of work is man! how noble in reason, how infinite in faculties! in form and moving, how express and admirable! in action, how like an angel! in apprehension, how like a god! the beauty of the world, the paragon of animals!" Who can deny then, that an anatomical knowledge of the human figure is the best education for the eye, and the basis of all grace and propriety in invention and design? The student needs to be reminded that his art will never be ennobled by only copying the orders of Vitruvius or Palladio. If the works of nature had not been their guide, the ancients had never attained to such perfection in architecture.

One of the most striking features in ancient art is grandeur. It was an object with the builders of antiquity to give great permanence to their works; a wish which sprung out of their natural love of glory and desire to appear great and enterprising in the eyes of posterity. An instance of the extravagance to which this passion carried them, is recorded in the tower of Babylon. Such a failure, however, occurring among men who were unguided by precedents and blinded to the consequence of their rash and presumptuous undertakings, would have the most beneficial results, and lead them to view the art of building *for eternity*, on more sound and philosophical principles. Curiosity has ever been busy in inquiring into the causes of things, and the most useful discoveries have arisen upon the errors of former ages. Michael Angelo had never, perhaps, raised a dome so triumphantly, if the attempt had not been made by others with less success before his time.

But although this sense of immortality is the first step towards a grand style, it depends likewise upon the goodness of the materials that are introduced, as it is these which give to buildings, whatever may be the purposes for which they are intended, all their character of strength and durability. Now, on these latter points, much of the fame of an architect rests, and for want of attention to them, we owe the ruin of many modern edifices. I allude to the one at Fonthill as an example most familiar to the reader. Every one remarks the great contrast between the size and dimensions of timber, for instance, used in buildings of a bygone age, with those of the present day; and the difference in their duration is equally great. The system of contract, which has been so prevalent of late years, and the heavy duty on materials of every kind, have operated powerfully in the change; and although in some cases the exorbitant proportions of strength observed in old houses seem to indicate an ignorance of the principles of construction, yet as they long outlast our feebler erections, and require force to raze them, we can scarcely blame what appears in some of their parts a want of geometrical skill. The architectural merits of our ancestors must be judged by the circumstances of the age in which they lived. They had doubtless been more sparing, and displayed more science in the use of their timbers, had they been less abundant, or had they been compelled, by the restraint of taxes, to make them answer their several ends with the least possible expenditure.

With regard to stone, we have no cause to complain of its deficiencies, or think lightly of the resources of our British quarries, although we have not the granite of Egypt or the marble of Pentelicus. Yet when we look on the dilapidated state of many of our edifices; when we think of the ruinous appearance of some of the colleges in the beautiful city of Oxford, the nurseries of so much profound learning and eminent piety, we have reason to lament the corrosive nature of the stones with which they have been constructed. In these latter, their rapid decay is owing to the broad surfaces of the laminæ or cleaving grain being presented to the action of the weather; and we see the result of placing them in a position contrary to that in which they lay in the quarry. One remedy for this evil would be the establishment of a society for testing the capabilities of stone and its fitness for durability, previous to its being employed on public and national edifices.

On the other hand the mild and equable temperature of the east was favourable in effecting for the ancients that perpetuity at which they aimed; they did not suffer from frequent frosts and sudden changes; their beautiful statues were not injured by that quantity of coal-smoke which accumulates in our dense cities; nor did they see a Parthenon or Erectheium perishing in the lifetime of its founder. Instead of a few years altering the appearance of their temples, they remained as firm and perfect as ever after the lapse of centuries, and promised to be as lasting as the rocks out of which they were originally hewn. The immense size and weight, moreover, of the stones which their architecture demanded, contributed, independent of the cement, to the stability and breadth of the masses. And as the site of their cities was generally on the tops of lofty hills, it being the custom with idolatrous nations to offer sacrifice on such places, it is evident that to raise such huge blocks to the required height, betokened some degree of mechanical skill. Besides, when they knew the grandeur of effect which would be conferred on their buildings from an elevated position, and the advantages it would give them over invaders, they needed not a further stimulus to exertion; nor would they be slow in applying the principles of geometry to the carrying forward those great works. The Egyptians were unquestionably masters in this science. But their simplest and most effectual method in transporting their vast monoliths (as may be learned from one of their own paintings) was the use of rollers and the incline; in fact they would *skid* these obelisks, and by means of proper tackle, set them up just in the same way as modern labourers.

If we consider their cement, we find, as in the aqueducts, it presents a hardness that is impenetrable to water; and this through no less than 2000 years. The Romans and Greeks were particularly careful in the making of their mortar and in the use of it; with us, on the contrary, it is deemed a second rate consideration, especially in house-building, and is usually committed to the least instructed class of men. Allan Cunningham, in his life of Wren, speaking of St. Paul's, says:—"Though the stones are hewn with the greatest nicety, and the masonry seems all firm and compact, yet the mortar which should unite the whole into one solid mass, is in many places decayed and become as dust. This is the case even with some of those piers against which the public monuments are erected; when the outer line of stone is cut through, the mortar comes gushing through the aperture; the sand is sharp and good, but the lime, like too much of the lime used in London, has been deficient in strength." Notwithstanding this defect, every one who knows that the architect endeavoured to give permanence to his works and secure the praise of posterity, will be glad he is deaf to the voice of his biographer.

Of the religious edifices of the middle ages, there are some which retain, despite of time and tempest, so much of their original beauty, that most of their ornaments and rich carving seem as if they were the work but of yesterday. There are even preserved to us those curious devices with which the early sculptors were wont to decorate their handy works; and whether they alluded to the mysteries of their craft, or were emblematic of some moral truth, were yet always used to mark and identify a favourite subject. I regard their sacred architecture with feelings of reverence; for cold, indeed, must be the heart of that man who is insensible to the sublimity of the Gothic, when looking upon the roof at King's College, the Minster at York, or the magic groining and tracery of Henry VII's chapel. There is something so ennobling in this style, that it is peculiarly adapted to our Christian churches. It is easy to point out its claims upon our admiration. The Gothic architects, well knowing that devotion would be heightened by great size, loftiness, and durability, preserved all these characteristics of grandeur; and it is when surrounded by them, we are impressed with the religion of the place, and feel that we are in a building dedicated to the worship of Jehovah. Everything is calculated to excite the most profound emotions. Worldly feelings die away, and piety grows warm when we view its consecrated walls through the obscure and subdued light which streams through the painted windows; when the voice of prayer alone breaks the stillness of its ailes; and, as the sounds of the organ thrill through our souls, we listen to the beautiful and affecting chaunt:—

Stabat mater dolorosa
Juxta crucem lacrymosa
Dum pendebat filius, &c.

During the period of the building of these magnificent structures art was the favourite study of the monks, and the most eminent architects were bred within the walls of the cloister. The abbeys, the cathedrals, and conventual churches, were planned and superintended by successive abbots and bishops; for learning then was a kind of monopoly, and chiefly confined to the clergy, and the nobles of the land. But this was a propitious era for architecture, inasmuch as there was less fear of its being debased by illiterate men. The knowledge of its principles, too, seemed to operate far more powerfully, when concentrated in such a circle, than when scattered in various forms over a whole community. It is thus that the noblest style and the most perfect system of architecture, as seen and universally adopted throughout Europe, is supposed, and with every probability, to have originated among the fraternity of freemasons. For such could only have been accomplished by many different minds acting in concert.

Nor were wealth and labour among the least causes which contributed to this end. To command them is indeed the object of every nation eager of renown, and desirous to distinguish itself by its public institutions and monuments. We admire the beautiful villas of Italy, her lakes and gardens, her palaces and academies for the arts, and we think of the rich cardinals and noble families who built them; we look at other stupendous fabrics and are reminded of the wealth of the Roman patricians. The prelates, too, of the great Catholic churches, from being prohibited to marry, had no motive for accumulating property, but expended it on the service of the altar; and aided by the munificence of princes, the donations of the people, and the revenues arising from monasteries, they were enabled to seek out, from both at home and abroad, the most skilful artists, for the purpose of making those edifices in all respects worthy of religion. Such a capital was applied by the Gothic architects for their embellishment. That unrivalled skill in construction—that elaborate ornament in sculpture, and those beautiful allegorical and legendary decorations, arose from this source. The interior of their churches became one mass of splendour; to compose them, the priests exhausted their knowledge of the passions; and with it they exhausted their fortunes.

The time and labour which were bestowed upon them equally deserve our attention. In our contemplation of any object to which genius has given all the excellence it is capable of, we seldom reflect upon the numerous difficulties through which it has struggled to perfection; although what appears as the effect of enchantment or produced without any effort of the mind, is generally the fruit of many years of painful toil. Those who witnessed the foundation laid of one of these great piles, and those who saw the last stone raised for its completion, were almost two distinct generations. During this long interval, separate portions were built at different times and by different hands; and this was especially the case under the Papacy; so that we find in the history of the cathedrals, a succession of bishops who added some screen, shrine, tower, or transept, in the design of which, they acquired great fame as architects.

This mode of building by degrees is at present rare amongst us. It has been lately followed in one or two parts of England; but the recommendation of it by the "Incorporated Society for promoting the Building of Churches," is likely to lead to its more extensive practice. The only evil that is to be feared will result from it, is the want of unity in design; as we see it in St. Peter's and other works in which this system was pursued.

(To be continued.)

CANDIDUS'S NOTE-BOOK.

FASCICULUS XLVIII.

" I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. It is curious to observe how much fashion and custom prevail in matters where they ought not to be allowed to have any authority. It is still the fashion to talk of Michael Angelo as a "great architect," and he is accordingly considered quite a luminary in that character—a mistake of which some of our now rather numerous Professors would do well to disabuse the public; at any rate those who can admire him and his caprices have no right to turn up their noses at those of Borromini. It is the fashion—with book-making tourists more especially—to extol Palladio, generally in "criticism pilfered from guide-books." And as it is also the fashion to make no mention of Calderari, or any of the buildings designed by him in the same city of Vicenza, the unfortunate Count Ottone is treated as a mere nobody. For tourists of the Trollope breed, who make trading voyages of their travels abroad, and who are content to return home with as much gossiping and blundering as will serve them for a book-making and book-selling job—for such persons there may be an excuse, since, if ignorance can be pleaded as a sufficient one, they may generally claim it most amply; but that a professional man, and one who made architecture the chief object of his journey, should not even so much as once mention Calderari or any work of his either at Vicenza or Verona, is almost incredible—certainly quite unpardonable. Nevertheless, after speaking of Palladio's buildings in the last-mentioned city, Woods says, "I will not trouble you with criticisms on other palaces, where there is nothing particularly beautiful to render them objects of study." Pitiful and humbugging evasion! Did he mean to say that Calderari, a decided *Palladianist* in his style, produced nothing that will bear any comparison with Palladio's own works? If such was really the case, that should have been a reason for his entering into the subject, and explaining wherein the great difference consists, and to what it is owing that, with far fewer solecisms and defects, Calderari's buildings are decidedly inferior to those of Palladio. This might have been rendered a highly interesting and instructive piece of criticism, therefore we may fairly suppose that Woods' reason for passing over Calderari was not that which he has assigned, but the unwillingness to "trouble" *himself* with any farther remarks on the subject of the palazzo architecture of Vicenza. The only mention at all I have ever met with respecting Calderari, in any English book, is—*pace* Joseph Gwilt—in an article on the "Palladian Architecture of Italy," in the *Quarterly Review*, where it pleases the "ignorant reviewer" to remark, "Ottone Calderari particularly distinguished himself by simplicity and elegance, and a knowledge of the true principles on which the beauty of Grecian architecture depends. The Loschi and Bessaro palaces at Vicenza, and the Seminario at Verona, are noble specimens of his skill." Where then were Woods' eyes—where those of the hundreds of others who have visited Vicenza only to prate like so many parrots about Palladio? It is just as if a foreigner, visiting England, should extol Temple Bar as a work of the "great Wren," and of course a perfect architectural gem, yet should not bestow a syllable upon the *palazzi* of Pall Mall. As to Buckingham Palace, the less any one, either foreigner or Englishman, says of that, the better. It is a thousand pities it was ever built, and at least five hundred that it has not since been burnt down.

II. The plea of insanity is now becoming a very fashionable, and is certainly a most convenient one. For some of the things they designed, both Nash and Soane, not to speak of a good many others, deserved to have been hanged; and if tried could have escaped only on the grounds of positive insanity. But then, those who employed them ought to have been hanged too—at any rate, ought to have been shut up in Bethlehem, as being equally insane. Oh! the untold millions squandered away upon lost opportunities! Let us not think of it, for it is enough to drive us all mad, and qualify us for the glorious *privilege* of insanity. Apart from their architectural phrenzies, there was, however, little in common between Nash and Soane; the one lived *en prince* and died a beggar, the other lived very much like a hunks and left a vast fortune, which he most assuredly would not have done could he by any possibility have carried it away with him. I well remember once being witness to a complete *scena*, in which Soane was the actor. In reply to some complimentary remark about his house, he burst out with "D—n the house! curse the house! Could I have my mind, I would tear it all to atoms this very instant—yes, this very instant. I am sick of hearing of it—I abhor it—I detest it—I loath it—I abominate it. And so you are come to see the house? There is a d—d dull day to come on such an errand. 'Tis as dark as pitch—as black as Erebus. Confound the house, it is my eternal torment, and a parcel of folks are continually coming here, to see the d—d house: they don't come to see *me*—no, I am nobody, they only come to stare at the d—d, infernal, abominable house!" After which furious explosion, and tempest, the old man suddenly became not only tranquil, but very condescending, gracious, and chatty. If he was really mad, there was also a certain degree of method in his madness, and a most extraordinarily queer method it was. "Rich and rare" are the anecdotes that remain to be told of Sir John Soane. I know one who promised to give a collection of them to the public, but he has not kept his word.

III. Independently of the egregious blunders with which it teems, the English translation of Milizia's Lives of celebrated architects, would disgrace a penny-a-liner. That work has been *done* into English, with a vengeance. It seems to have been done by way of exercise while the translator was learning Italian, and in all probability such was really the case. The best part of the book is the index, which as matters go, is saying something in its favour, indexes, even to books of reference, having now gone almost entirely out of fashion. No matter, this is an age when, thanks to the march of intellect, everybody reads and nobody studies.

IV. So Albert has actually shed the light of his countenance and the glory of his presence on the Institute of British Architects; yet his visit to it turned out one of the dullest and flattest affairs imaginable. If the Institute really felt flattered or encouraged by it, they must be the most easily satisfied mortals breathing. Of course all was conducted very "properly;" no blunders were committed either on the one side or the other. The Prince was exceedingly prudent and discreet—which for a Prince, is saying something: he did not attempt any compliments; he did not pretend to congratulate the Institute on their unwearied zeal, and on what they had done for the advancement of architecture in this country. In abstaining altogether from *blarney*, his Royal Highness showed good taste, but he certainly did not manifest the slightest cordiality or sympathy with them. The whole affair was mere matter of form and ceremony—at once perfectly correct and intolerably chilling. The Prince seemed to consider it a bore—how the others relished the taste they got of Royal condescension and patronage, I pretend not to say. There was, at all events, a paragraph for them in the newspapers and *Court Circular;* but as to the patronage itself, that is likely to turn out a mere phantom—of just as much real service to the Institute, as the Institute itself is to the art and the profession.

V. "I cannot recommend frescos," says Mr. Eastlake, "for the sitting rooms of dwelling houses;" a very reasonable piece of advice, now that we seem to be threatened with a fresco mania. If that mode of painting is to be employed for the merely general decoration of walls, it would soon sink to the level of paper-hanging, and its greater pretension would chiefly serve to render it all the more paltry and unsatisfactory. On the other hand, if it is to be employed for subjects upon a large scale, and with figures of the size of life, it would be a most obtrusive and oppressive species of decoration. In that respect painted ceilings are objectionable enough, but they are comparatively quite removed from notice. Saints and virtues may cut capers over our heads, and dance jigs in the clouds, without our being compelled to look at them; but it would be very different were the walls of our rooms to be peopled with such figures—poetical or

historical, and converted into so many "scenes." Pictures in frames do not force themselves importunately upon our attention: while they contribute to general embellishment, they do not *insist* upon being looked at; but we may do so or not according to the humour of the moment. Few would relish dwelling in rooms where the same scene, be it either solemn or the contrary, is constantly acted before their eyes. However masterly the paintings themselves might be, they would soon sicken of being shut up in a Miltonic "Paradise" or "Pandemonium," or a Dantean "Inferno;" while a perpetual Elysium would be likely to inspire them with the blue devils. Nay it is not every picture that one would care to have hung up in a drawing-room or other domestic apartment: the "Lazarus" of the National Gallery, for instance, would not be particularly desirable or exhilirating as a companion in such a place. It is all very well to talk about fresco-painting and the grand style of art: yet it does not follow that we are bound to admit them into our houses. They neither suit us, nor do we suit them; which may be unlucky, but is nevertheless the case. The truth is, we are a very matter-of-fact people, and live in a very matter-of-fact age; nor will all the arguing in the world render us otherwise, for we might as well attempt to change the natural atmosphere, as the moral one which surrounds us. It is very easy to say, let us revive this, or revive that; but how are we to infuse actual life and vitality into that which has been extinct long ago? The utmost we can do is to conjure up the mere ghost of it, and for ghosts the world has now little relish. The king of Prussia is now endeavouring to revive the Greek theatre and Greek drama in their pristine purity; and he will do so—but how?—precisely after the manner in which Eglintoun brought back again the age of chivalry, with its pageants and tournaments. It would perhaps be wrong to say that art in this country is not yet *ripe* enough for fresco painting, since it is more likely to be too *rotten*.

SUGGESTIONS FOR THE MORE EXTENSIVE EMPLOYMENT OF CONCRETE IN DISTRICTS WHICH DO NOT POSSESS ROCKS SUITABLE FOR BUILDING PURPOSES.

It is now many years since our active neighbours, the French, undertook on a very large scale, the manufacture of artificial hydraulic limes, with a view principally to introduce them as an ingredient into that species of concrete which they have termed béton. Following in the track of Berthier, Vicat, and Treussart, our own countryman, General Pasley, has long since endeavoured to arouse the attention of landed proprietors, engineers, architects, builders and others, to the method of forming artificial cement, by the mixture of chalk and clay in certain proportions, which should vary according to the qualities of these two ingredients. Hitherto, however, notwithstanding the perfect success which has attended the manufacture in the neighbourhood of Paris, where it is carried on at this day on the very same principles as those which General Pasley first had the credit of introducing to this country, nothing has yet been done by ourselves to carry out the practical application of a process which is evidently calculated to afford a very fine field for the employment of labour, the exercise of skill and ingenuity, and the profitable investment of capital.

Under the general head of calcareous concretes may be classed all those substances which are composed of fluid mortar mixed with broken stones, gravel, pebbles, fragments of bricks and tiles, or such other hard mineral substance as may be at hand. An ordinary concrete is that which is made from a common chalk or other lime stone which does not possess the property of setting under water. On the other hand, the quick setting limes, and those which possess hydraulic properties, as the Barrow lime, the Aberthau, that of Lyme Regis, and other places, as the lias formation, compose the species of concrete which is termed béton. Now it is known that all the limes which have been mentioned, owe their hydraulic property principally to the presence of a small quantity of clay in intimate combination with the lime. Hence it is that Roman cement, which is burnt from an argillaceous limestone containing more clay than any of the before-mentioned, and indeed more than any of the rocks properly called limestones, forms in concrete a more perfect kind of béton than any other. Conceiving an ordinary limestone to form a simple concrete, and conceiving Roman cement to form a true béton, all other kinds of limestone may be considered capable of forming a mixture intermediate between simple concrete and true béton, according to the proportion of argillaceous matter they contain.

It is quite a mistake to suppose that the béton so much in use throughout France, Holland, Italy, and other states on the continent, is invariably composed of broken stones mixed with lime, &c. Such appears to be a mistake into which O. T. of Newcastle has fallen in his paper on concrete, in the *Journal* of February last, since he observes "that béton differs from concrete in broken stone being used instead of gravel, in the proportion of two of stone to one of lime or pozzolana of Italy, &c." Now the truth is, that although broken or angular stones are commonly used in the manufacture of béton, yet gravel and pebbles are not unfrequently made use of; and the real and true distinction between concrete and béton lies, as we have already said, in the employment for the latter of a more or less hydraulic lime instead of a lime made use of for ordinary mortar.

Among the best of the hydraulic limes employed for the French béton, may be mentioned that of Metz and that of Senonche near Dreux. The hydraulic limes of Tournay in Flanders and of Viviers upon the Rhine, are also of excellent quality. The hydraulic limes manufactured in the neighbourhood of Paris are composed of three parts of chalk ground into powder, and made up into paste with two parts of plastic clay. This mixture is formed into cakes, burnt in a kiln, and then ground to powder.

Application of Concrete to Building Purposes.

The Romans extensively employed concrete not only in building walls of every description, but even constructed vaults and arches entirely of this substance. Examples of this are found in the remains of their baths, their theatres and temples. The arches in the Coliseum, in the baths of Caracalla, in the temples of Peace, of Minerva, and of Venus, are mostly of concrete with an occasional rib of brickwork.

The spherical vault of the Pantheon at Rome, which is 133 Roman feet in diameter, and also a great vault at the baths of Dioclesian 74 feet in diameter, were both built of concrete, and their condition is as perfect at this day in point of stability as when they were first erected. A more modern example exists in the great concrete vault for the dome of St. Peter's, which is 82 Roman feet in diameter, and 141 in height. While admitting that the excellent preservation of many Roman walls in Italy, Spain, and the south of France, clearly proves the almost imperishable nature of the concrete or béton of which they are composed, it has been objected by many modern architects, that the variable climate of Great Britain is unfavourable to the duration of concrete in exposed situations, and the opponents of concrete have not hesitated to affirm that, if those Roman monuments, whose preservation we so much admire, had been tested beneath a more changeable sky, and exposed to the rigors of a more northern clime, they would have furnished far different evidence, that is, far less favourable evidence of the value of concrete for building purposes. In reply to this, however, it will be sufficient to adduce numerous old castles which were built in this country soon after the Norman conquest, and whose walls, consisting of irregular masonry, which bears a close resemblance to béton, are found at this day in a state of excellent preservation. The great Pictish wall, which is well known to have been executed by the Romans, is also a striking instance of the durability of well composed béton; and upon the whole we are justified in concluding from ancient remains existing in our own country, that where good hydraulic lime is employed, béton will last even in the atmosphere of Great Britain, for at least as many centuries as most of the stones at present employed for building pur-

poses. We have observed in the walls of many old castles in England, that the stones have been greatly decomposed and eaten away by atmospheric influence, while the mortar joints stand out in relief and indicate what was originally the face of the work. In such cases the mortar has been obviously far superior to the stone, and this superiority is further evident, by trying the relative hardness of the two. While the stone will crumble away and yield to any metallic edge applied to it, the mortar can only be impressed with considerable effort. Now we do not hesitate to affirm that the same excellence as that for which the ancient mortar is so celebrated, has never ceased to be within our reach in this country, which is fortunately favoured by an abundance of the materials most proper for the purpose. In works of this kind the ancients had no secret with which we are unacquainted, but on the other hand, the researches of modern chemistry have brought to light a great deal connected with the subject of mortars and cements which in all probability our ancestors knew nothing about. The fabrication of artificial cements and hydraulic limes is entirely a modern discovery, and one of which the Romans were perfectly ignorant.

It appears quite clear, from all we can gather on the subject, that the superiority of ancient mortar depended chiefly on a judicious choice of good stone for the purpose of burning into lime, and afterwards upon careful attention to the manipulation of the calcined lime; and such being the case, there is no reason on earth why modern buildings of every kind should be constructed of materials less imperishable than those which our Roman and Norman ancestors made use of.

The great sea wall at Brighton, the dock walls constructed of concrete at Woolwich, and a church said to have been lately built near Brighton entirely of concrete, afford examples of what may be effected by this material. It is quite certain, however, that several circumstances have most unfavourably operated to retard the more general employment of this most valuable substance. Among the foremost of these, we cannot avoid referring to the patent which was taken out a few years since for forming concrete into artificial stones. The signal failure which attended the use of this artificial stone in some government buildings at Woolwich and other places, has too hastily led many engineers and architects to regard as impracticable the employment of concrete or béton for building above the surface of the ground. But let us observe the difference between small blocks of stone formed of concrete and the firm cohesive body which the substance presents when used *en masse*, as it always should be. The stones which were manufactured of concrete were found, as might have been expected, so tender and brittle at every corner and arris, that it was almost impossible to preserve them with perfect edges up to the time when they were set in the work. The process of setting them by mortar in the same way as ordinary stones, left these tender arises still exposed to injury, and it was no wonder that all along the joints a destruction of the walls took place to a very serious extent. It appears to have been the practice, in forming these artificial stones, to face them with a kind of plastering, which is said to have pealed off in great quantities from the action of frost and other external influences. We repeat that this absurd project for making concrete into blocks of stone has greatly impeded the real advantages of concrete from being properly appreciated. We protest, however, most strongly against any inference being drawn unfavourable to a judicious use of concrete from the failure of this attempt to form it into artificial stone.

According to the system of building with concrete, which we propose, the walls should in all cases have coins and coping of stone or brick, so that only a smooth plain face of concrete will be exposed. By adopting this method, no sharp corners or edges will be liable to injury from external violence, and there will be no irregularity or broken roughness in the work to admit the lodgment of moisture and occasion that injury which always takes place when frost ensues. To substitute a pile of separate cubical blocks of concrete for the solid mass of which a building may be at once constructed, appears to us in no respect more rational than the act of a man, who in proceeding to found upon solid rock, should break the rock in pieces, and join these pieces separately together, instead of founding at once upon the solid material. It may be said that we employ stone and bricks in cubical blocks of small dimensions, but this is a matter of necessity not of choice. Nature furnishes in the quarry blocks of stone, which have a fixed and limited size according to the natural beds, joints and fissures by which the strata have been divided, and in the case of bricks the convenience of manufacture, particularly with reference to the condition of being properly burnt, limits the size to comparatively very small dimensions. In building with concrete, however, no such limits exist, and there can be no comparison between the expediency of fabricating little detached pieces of concrete stone, and that of raising the whole mass of any house, wall, or building, by united and continuous layers extending without a joint over the whole area of the building.

In seeking for another cause why concrete or béton has not been successfully employed of late years in this country for building above the surface of the ground, we are strongly inclined to the belief that a fair and workmanlike attempt has never been made under judicious superintendence to apply a good hydraulic lime to this purpose. It is indispensable, in constructions of this kind, that the lime should possess some degree of hydraulicity, in order that it may harden before the injurious action of frost comes upon it. It is generally admitted, that mortar which contains no hydraulic principle, that is, mortar made from pure, or as they are technically called, fat limes, require a very long time to set perfectly hard; and it has even been asserted by experimentalists, who are well worthy of credit, that mortar has been found in a soft pasty state several years after it had been used in a building. On the other hand, hydraulic lime will harden in a very short time—requiring, in fact, a period which varies inversely with the strength of its hydraulic principle, this period, in the case of Roman cement, the most hydraulic of all mortars, seldom exceeding a few hours. The readiness with which concrete, composed of strong hydraulic lime, is found to set, confers peculiar value on béton for building purposes, because when once hardened, it is no longer subject to be affected by atmospheric changes, and may safely defy the influence of rain, moisture, frost, and the other destructive means by which imperfectly hardened mortar is so speedily destroyed.

As we have no wish to disguise or conceal what may be called the unfavourable side of this question, it may be as well to refer in this place to the opinions expressed by Lieutenant Denison and other officers of engineers, upon the use of concrete for building purposes. The opinions of these gentlemen are hostile to the employment of concrete, and are founded upon experiments and observations made upon concrete walls at Woolwich and some other places. Now we are perfectly ready to give every possible credit to the officers of engineers, for the care with which these experiments were made, and the fidelity with which these results have been recorded. We believe them also to have been free from any prejudice against concrete in the first instance; but granting all this, we are greatly mistaken if they have made use of the right material. Their experiments appear to have been made upon a simple concrete instead of a true béton, and owing to the long time which the former requires to harden in this climate, it was found to have been dissolved by water, and to have been shattered by frost before it had been allowed time to set. When we look at the undoubted fact, that constructions of béton have actually been practised in France with great success, within the last few years, there are only two ways of reconciling the anomaly which their reputed failure in this country appears to exhibit. Either the experiments have not been made with proper care and with good faith, or they have been made upon the wrong substance. At once, without a moment's hesitation, we reject the former supposition, and decide that the latter must have been the case.

In order that no doubt may remain on the minds of the sceptical with respect to the perfect success which has attended the use of béton for actual building in France, and at the same time to convey some knowledge of the process and style of building adopted, we

shall here lay before our readers some particulars of a dwelling house lately constructed entirely of béton, by M. Jean Auguste Lebrun, upon his estate at Marsac near Albi, in the department of Tarn. This building consists of three stories, with three rooms in each floor, and a large granary or garret at the top. Along the front of the house extends a gallery which has a height equal to that of the building itself. Not only are the walls of this house composed of béton, but each floor is supported upon arches of béton thrown across from one wall to the other, so that throughout the whole building scarcely a particle of timber is made use of. The arches which support the first or principal floor have the following dimensions.

That for the gallery or passage, has a chord or span of 10 ft., a rise of 1 ft. and a thickness at the crown of 4½ in. The three arches which support the three rooms of this floor are each 17 ft. 4 in. in span, with a rise of 3 ft. 3 in., and a thickness of 10 in. at the crown. The roof of the building is formed by two semicircular arches, one covering the granary already mentioned and the other covering the gallery. The principal of these arches has a span of 20 ft. 3 in., with a thickness of 10 in. at the springing and 6 in. at the crown. The smaller arch over the gallery is 10 ft. in diameter, with a thickness of 6 in. at the springing, and of only 3 in. at the crown.

The béton was generally composed in the following proportions—

One part of lime slacked by immersion;

One part and a half of pure sand;

And two parts of gravel or broken flints, from 3 to 5 in. in diameter, according to the thickness of the walls in which they were to be employed. Thus the largest stones were used for the thick exterior walls, those of smaller size for the large arches, and the smallest of all for minute arches and ornamental mouldings on the outside.

The béton was in the first place well mixed up by hand labour, and then thrown into a framework or encaissement in regular courses of 1 ft. in thickness. This encaisement was simply composed of a few uprights, to which were secured horizontal planks placed on edge one above the other at the proper distance apart, so that when removed, the béton filled in between them shall occupy the proper thickness required for the wall. This method of raising the walls in courses of about 12 in. deep, appears to have been practised by the ancients in building with béton. The system will be quite familiar to those of our readers who have even witnessed the building of mud or earthen walls, as practised at this day in the Lyonnois and other parts of France, in the eastern countries, and in a ruder form even in this country and in Ireland. The arches for supporting the floors were turned upon centres of the usual kind, and the exterior mouldings in front of the house consist of béton filled into mounds prepared to receive it. A thin layer of lime mortar was plastered over the exposed surfaces of the walls. This plastering was pointed to a sharp arris at all the exposed edges, and seemed to give to the whole structure an appearance of smoothness and regularity which could not be expected from the naked béton.

In the summer time the béton of one course was generally sufficiently set in six hours to admit of the next course being filled in, and about twelve hours were required in spring time. As each course was regularly completed throughout over the whole area of the walls, the part which had been first filled in was commonly set by the time the course was finished, so that no delay took place on the completion of the separate courses. The centres for the arches of the gallery were struck at the end of a month after its completion, and those of the large arches were removed at the end of two months and a half. It was found that after this interval the béton had acquired so much consistency as to produce no thrust upon the abutments.

The exterior surface of the front wall, and the outside of the great arch which forms the roof, were painted with several coats of oil paint. This was done as much for the purposes of decoration as to enable the surface to withstand more perfectly the rain and frosts of the succeeding winter. It was found afterwards, however, as far as durability was concerned, this precaution was unnecessary, for those parts which had not been covered with paint, perfectly resisted all the rigors of the most severe seasons.

Not only has M. Lebruce, the architect who constructed this building, declared its perfect condition, after the lapse of two years, but he has accompanied a report, which he addressed to the *Société d'Encouragement*, with certificates from the prefect of the department of Tarn and the sub-prefect of the arrondissement of Gaillac, both of which attest the perfect solidity of the building, and state that it presents all the appearance of stone. In order to try the strength of one of the arches supporting the principal floor, it was loaded three months after the centres were struck, with a mass of earth 10 feet in thickness, and extending over the whole top surface of the arch. The weight thus applied amounted to 1250 lb. per square foot, or about eight times as much as that which a floor supports when a room is full of people, and this weight was borne without the slightest injury to the arch.

The great economy of this method of building is highly important. It appears that the cost of the whole work was no more than 5s. 3d. per cubic yard, which is about one-third the price of brickwork in that part of France.

It may be necessary to explain that the process of slacking lime by immersion, which is mentioned in a former part of this description, is performed in the following manner. The lime stone, after being burnt, is taken from the kiln and placed in a pan in pieces from the size of a walnut to that of an egg. The pan is then plunged for a few seconds into water, and withdrawn as soon as the lime begins to emit heat. After this operation, the lime continues to heat and swell and falls at length into powder. It is placed in this state in chests or casks, where the heat being concentrated, and a great part of the moisture being condensed and not allowed to escape in steam, will be again taken in by the lime which is then more perfectly slacked than otherwise. If the lime is intended to be kept any time before being used, the chests or casks should be covered with straw and placed in a perfectly dry place entirely removed from any danger of being penetrated by any kind of moisture.

(To be continued.)

ARE SYNCHRONISM AND UNIFORMITY OF STYLE ESSENTIAL TO BEAUTY AND PROPRIETY IN ARCHITECTURE?

An Essay to which was not awarded the medal of the Institute.

BY A STUDENT.

THE question whether synchronism and uniformity of style are essential to beauty and propriety in architecture, is so novel, that it might have been well had the Institute of British Architects accompanied their proposition by some definition of the terms in which it is conveyed—or at least set some limit to the sense in which they are to be understood.

Of all the arts and sciences, none has ever been, or must necessarily be, more strongly affected by the inexorable course of circumstances, than architecture. None has been found more essential to the civilized existence of mankind. None has contributed more to the comforts of the humble, to the grandeur of the mighty, or to the gratification of the refined perceptions of those blessed with taste. None has so perfectly attained the combination of the useful and the beautiful. Since architecture assumed the conditions of an art, human genius has been on the stretch in every period and in every community, to bend its capabilities to existing manners and circumstances, and to study the modifications dictated by climate, by religion, by the comparative progress of the sister arts, by the state of mechanical science, and the minor effects exercised by soil and the choice of materials.

That architecture, practised during a long succession of ages, and modified by these and many other influences, moral and physical, should have exhibited the most opposite extremes in style, seems a necessary condition of its existence as an art. If, therefore, by synchronism and uniformity is to be understood the strict adherence, at the present period and in the locality of Great Britain, to any style

of architecture appropriate to any other period or any other locality, such a condition seems *primâ facie* not only *not* essential to beauty and propriety, but to be utterly incompatible with any state of architecture worthy to be dignified by the name of art. It may be asserted that no such principle has ever obtained in any recognized school of architecture, and its conception seems altogether due to the new light, (or darkness visible,) thrown upon architecture some fifty or sixty years since.

Widely as the styles of architecture, which the lapse of ages has spread over Europe, may differ from each other—numerous as may be the subordinate varieties to which the great divisions of style may have given rise—the elements of all will be found few and simple. The origin of the existing architecture of Europe, must be sought in the works of the Greeks. The inventive faculties, and the fine perceptions of that people, have produced the most perfect adaptation of the means afforded by architecture to the end upon which they were employed, that has ever existed, and more perfect than can ever exist again; because the objects to which their architecture was adapted were compatible with its simplest forms. Until other nations have the same objects to fulfil, they never can use the same simple means with equal propriety, nor consequently produce by them the union of usefulness and beauty in the same degree. The simplicity of Greek architecture, its *oneness*, (to use a phrase of the cockney poets,) is the element which not only forbids its reproduction synchronically, but defies the invention of its parallel. To the simple elements which the felicitous genius of the Greeks reduced to the conditions of an art, may be traced all the systems of architecture which have followed in succession. From the Greek to the Roman, from the Roman to the Romanesque, from thence to the Byzantine in one direction, and to the Arabesque in another, from the Byzantine to the later Romanesque, and from thence to the Gothic, from the Gothic again to the Italian Renaissance, and from thence to the classical Italian schools, and the French and English schools of the 17th century, are transitions familiar to every architect who has studied the history of his art. These are styles, every one of which, judged by the circumstances under which it arose, and the purposes to which it was applied, whether civil, military, or ecclesiastical, will bear the severest test by which architecture can be tried—the test of usefulness, propriety, and beauty, mutually dependant upon each other. But where among them is to be found what it is presumed the Institute mean by synchronism and uniformity of style? If the hypothesis be founded that Greek architecture owes its origin to the Egyptians, it is evident that it never could have existed at all had the Greeks been infected with such a principle.

After ages of prosperity, English architecture languished in the hands of the followers of Lord Burlington. To something analogous to this synchronism we may perhaps trace its decay, since the unmitigated imitations of Palladio by the Burlington school, ended by driving the public taste to take refuge from their insipidity in the frippery decorations of the Adams.

The publication of the discoveries of Athenian Stuart was hailed as the means of a thorough regeneration of architecture. Greek and Roman republicanism shortly after filled the mouths of the orators of Europe, and the simplicity of the Greek style carried with it a prejudice that it might be "*done cheap*." Under these circumstances Greek architecture appealed forcibly to the vulgar. Those who really felt and appreciated its exquisite purity and refinement, unfortunately overlooked the fact, that those very qualities rendered it inflexible to the combinations necessary to adapt classical architecture to modern requisitions. The Romans knew better. When they adopted the orders of the Greeks, they modified them with consummate skill, to fit them for combination with the arch and with each other. The modern Greek school jumped to a different conclusion, as logical as the sentence which annihilated the Alexandrian library. Greek architecture, like the Koran, being perfection, nothing could be necessary or expedient which was not contained therein, and in this conclusion triumphed the principle of synchronism. A brilliant popularity could scarcely fail to attend a doctrine pointing out a royal road to architecture, rendering superfluous the tedious study of the theory, the philosophy, nay, the very grammar of the art, and conducting to the glory of a Callicrates or an Apollodorus, every possessor of a Stuart's Athens and a pair of compasses. Roman architecture was rejected as spurious—the Italian schools dismissed with contempt—Inigo Jones esteemed an ignoramus—Wren a bungler—Vanbrugh a barbarian—Burlington a humbug—Chambers an imbecile. They built no Greek! As reasonably may Burke or Canning be decried for not declaiming in Greek. The principle would place Chatham below the school-boy who spouts a Greek oration by rote—no inapt parallel to the architect who compounds his odds and ends out of Stuart's Athens (not forgetting the supplements) to eke out his ready made portico, and looks with disdain upon Vignola and Perrault. If we suppose the boy's oration to consist of unconnected words like nonsense verses, the similitude may run a little closer.

Had Greek architecture been studied in a Greek spirit, important advantages might have resulted from its revival, but it is by no means certain that its peculiar forms and character will ever permit it to be amalgamated into any such combinations as the Italians have effected with the Roman, the flexibility of which as displayed in their hands, enabled it to become the universal style of modern Europe, (modified by each country according to its wants,) until the Greek mania superseded it in Great Britain. *Purity* has ever been the ultimatum insisted upon by the advocates of the Greek style; but if a Greek architect could rise from the dead he would scarcely admit the purity of Anglo-Greek architecture. To face a building with an *avant-corps* much below its height, for the sake of introducing a single order—to back a Greek Doric portico with two stories of windows, or to flank it with arches cut into segments, and shorn of their impost and archivolt, that if they are not Greek they may at least look like nothing else—to associate the most decorative modification of the Greek Ionic, with doors and windows mulcted of their architraves—to condemn pilasters as a Roman invention, and to range Greek antæ on a wall—to force into combination two or three crude imitations of Athenian buildings where one has been found unmanageable—our resuscitated Greek would surely not admit that either the letter or the spirit of his art had been followed in such treatment of it.

These observations on Greek architecture, in its modern acceptation, have been put forward, because it is to the introduction of this style that the principle now recognized by the Institute under the name of synchronism is chiefly due, and its failure most signally apparent—so much so, that the argument may be thought levelled at a by-gone subject of discussion. The error is not, however, so worn out, but that designs may still be seen for purifying St. Paul's, by elevating a couple of lanterns of Demosthenes at the west end—opinions still heard, that Blenheim might be improved by the infusion of a little Athenian detail—commiseration still bestowed on Sir Christopher Wren, for the limited intelligence upon architecture in his time. If these freaks of fancy be not so rife as they may have been at an earlier period of the present century, they have been replaced by others not more to the credit of British architecture, upon which there will be a few words to say presently. In the mean time, it may be observed, that if synchronism and uniformity of style be indeed essential to propriety and beauty, then have the architects of the world been in a long error of some three and twenty centuries. Admit the principle of synchronism, and architecture ought to have stood still since it attained perfection at Athens. The Coliseum, the Thermæ, the Basilicas, Santa Sophia, the Alhambra, the churches of Amiens and Salisbury, the Vatican, the Palazzo Farnese, the Louvre, and a few other works by a few other architects, to which and to whom the world in general, down to the ultra-enlightened period of modern Greek, have agreed to allow some meed of praise, must all be denounced as worthless, should synchronism be essential to beauty and propriety, since they have all arisen from the perpetual state of transition of the art. What aberration from synchronism and uniformity is to be tolerated for the purpose of forming new styles? Where is the line to be drawn by which different styles ought to have been set apart as worthy to afford a new starting point for synchronous

treatment, or where are they to be separated for the future? Or are the architects of the present day alone to be limited to the servile imitation of styles gone before, and their whole intelligence limited to treating them synchronously, excluding invention and the study of character and fitness as beyond their comprehension? What style is to be selected as best fitted to our exigencies—or are we to set up here a bit of Greek, there a bit of Italian, Arabesque in this place, Cinquecento in that, Gothic or Egyptian in another, to show how perfectly we have studied synchronism and nothing else! Forbid it ye sacred muses! and forbid the Institute of British Architects to entertain questions which expose them to the eyes of all Europe as plagiarists and imitators *propensè!*

Of late years, our ancient national architecture has occupied much of our study, and the investigation of its transitions has done much to fix this said principle of synchronism upon our practice. It is a wretchedly narrow path which our architects have chosen, and it is to be hoped that it may widen as it is pursued. It has certainly expanded since a Gothic cloister of the 13th century was erected for a ball-room (at Belvoir castle.) This work is executed with a knowledge of style and detail, with an attention to synchronism in one word, which leaves nothing to be desired so far; and it is evident that the clerical amateur architect, who has to answer for this performance, was perfectly innocent of the knowledge that anything was to be desired beyond it. Let us hope that such an error may not infect our professional practice, and that we may not be too complaisant in yielding to the prejudices and prepossessions, which a march of ignorance, unparalleled in activity and impudence, is just now spreading through the land in the shape of "a little learning." Our Gothic architecture and the peculiar national modification of the Italian which succeeded it, have been extinguished upwards of two centuries. The reformation of the church in the first place, and the alteration in our habits and customs since the erection of the last of those domestic edifices which it is now the fashion to revive, point to the necessity of some modification of the architecture of the middle ages, both ecclesiastical and civil, not very consistent with the principle of synchronism and uniformity. This consideration leads to a question involving these principles in something like a dilemma.

How are we to dispose of the mixed style which forms the principal stock in trade of this revival as far as domestic architecture is concerned?

The remains of the habitable portions of our great castles, and of some few buildings of a more purely domestic character, show clearly that in the earlier period of our architectural history, little attention was paid to the internal fittings, which now constitute the necessary comfort of our mansions, even of the most moderate class. Bare walls and such inconveniences as attend grated windows and ill-closed doors, were the general lot of those who could not afford the luxury of tapestry. Wainscot linings were not unknown, but their use was certainly not common, and none of an early date have survived. By the time a demand for more habitable interiors became general, the Gothic style was on the wane, and we may be troubled to find an interior among our ancient mansions, fitted up in a manner approaching even the commonest exigences of the present day, in which the wood and plaster work does not bear another character, although the fabric itself may be very unexceptionable Gothic. How far this mixture was carried, and how far it presently affected the fabric, it is unnecessary here to explain—but it may be observed, that the first Italian architect whose works are still extant in England, exercised his discretion in some very important modifications of the style he imported. The works of John of Padua exhibit as genuine a specimen of the school of architecture to which he belonged, as will be found in Lombardy itself—but with this difference—he adopted the English window and the English chimney. It did not enter into the mind of this distinguished architect, to condemn his clients to darkness and damp, for the sake of following the arrangements expedient in his own climate—in other words, he did not think synchronism and uniformity of style necessary to beauty and propriety. The example set by John of Padua became the type of the architecture of Elizabeth and James I, and the question is, when we recognize this mixture as a distinct style, and follow it, as the fashion now is, do we not set synchronism and uniformity in direct opposition to each other?

Some modern examples there are, of interior fittings founded altogether upon Gothic forms, but certainly possessing nothing of the Gothic character. A plaster cornice bordering a flat plaster ceiling is not Gothic, however scrupulously the mouldings may be profiled or the foliage modelled—a sash window with its apparatus of folding shutters is not Gothic, however artfully its structure may be disguised —a door case with its architrave and cornice, rebated jamb linings and butt hinges, is not Gothic, though its head may be pointed, and most orthodox putty squeezes glued into the spandrils—and yet this sort of internal architecture has been coined, in preference to adopting what was considered an inconsistency, though practised boldly and successfully by our ancestors of the 16th century.

Perhaps we are held bound, when circumstances call upon us to work out an early style of Gothic, to make everything cold and comfortless for the sake of synchronism and uniformity. This position would undoubtedly solve the dilemma, and the architect would then only have to persuade the inhabitants of his dungeon to dress themselves in the ancient costume and cultivate their beards, to speak Norman French, pray in Latin, eat with their fingers, and drink ale out of leather black jacks for breakfast, in order to earn immortal glory as a restorer of the arts.

We may aptly conclude with the following observations of the late Allan Cunningham—

"We never can lawfully become heirs to the fame of men who wrought in other lands and died three thousand years ago. No poet will claim as much merit from translating Homer or Dante, though he should excel Cowper or Cary, as he would deem his due had he written a Fairy Queen or a Task—but your architectural copyist takes a much loftier view of himself—he imagines he has achieved something truly grand, when he has persuaded a prince or a peer to have a house, every pillar and architrave of which can be justified from antique example. This servile spirit disgraces the architecture of our country—Greece will never surrender to us the honour of her porticos, or Italy of her elevations, and there is the more reason that we should dwell on the memories of such men as Wykeham and Vanburgh, whose genius, whatever else we may say of it, has at least given us architecture that we can honestly call our own."

THE CHAPTER HOUSE OF SALISBURY CATHEDRAL.

Read before the Institute of British Architects.

By T. H. Wyatt, Esq., Fellow.

Mr. Chairman & Gentlemen—I have always felt that there are no subjects of communication which may be made more generally useful to our members, than observations on *points of questionable construction*, or *propriety of style and date*, occurring, as they frequently must, in our practice. The paper read at our last meeting by Mr. Granville, has strongly confirmed me in this belief; it was one which could not fail to interest and instruct all who heard it. Acting, then, on this strong conviction, I venture to lay before you the particulars of a case which will, I believe, well repay its consideration.

The Chapter House of Salisbury Cathedral having fallen into a neglected if not a dilapidated condition, and the Lord Bishop of that diocese, being desirous to take upon himself the restoration of this interesting building (and so far to assist the funds at the disposal of the chapter, already hardly sufficient for the mere repair of the Cathedral itself), did my partner and myself the honour to ask for a report as to its present condition, and advice as to its entire restoration.

My first step was to inform myself of the history of this portion of the Cathedral group, and I referred to a variety of works bearing on the subject, and to such records as existed in the Cathedral library, at all likely to assist in the inquiry; but the amount of information they furnish is very slight, the Cathedral itself usurping, in all of them, almost exclusive consideration. There is no record of the exact period when this room (if I may call it so) was built, or in whose bishoprick. It is supposed to have been commenced a few years

after the completion of the Cathedral in 1258, and its design is attributed to Bishop Bridport, who died in 1262 Price, in his history, published in 1753, merely affirms, "that by several diligent searches into and careful inspections upon the nature of the work, I find that the Cloisters, Chapter House, and Monument Room, were not begun till the Cathedral was considerably advanced, because the stone-work is not bonded together, as it must have been had all been carried on together, though manifestly by the same architect." But by whomsoever built, it must have been, in its original state, "with its central clustered columns, its vaulted roof and ramified ribs, its light, large and lofty windows, all decorated with stained glass, its sculpture, and a floor paved with richly glazed tiles," perhaps the most beautiful room of its class in Europe; or as Gilpin says, "nothing in architecture being more pleasing." The only paper or notice relating to it which I can hear of amongst the Cathedral records, is the following quaint report made in 1691, by a Mr. Thomas Naish, clerk of the works to the fabric; with an estimate of the charge of bringing it into good repair. "And first to begin with what threatens the suddenest ruin'. The Chapter House is an octagon of 68 feet diameter built with too slight abutments to support the thrust of the vaulting, the least space of time (the weight of the former being too little for the thrust of the latter) were not the springers of the vaulting braced together with 8 bars of iron united at the centre, and fixed in hooks at each angle, which hooks are gutted with lead to fix them to the wall, but by the thrust of the arching several of these hooks are drawn out of their first place, some six inches, some more, some less, by which means the vault is spread and hath rent the walls in several places 3 in. or 4 in. wide, and drawn the columns which standeth in the middle (being not more than 16 in. diameter) about 6 in. from its perpendicular, and by a small declension further, must in all likelihood fall to the ground. The roof is also decayed, *and thrusts the walls outwards and helps towards its ruin.* Some of the buttresses are decayed at foot, the stones being loose or scaled by frost. Part of the walls between the vaulting and roof is by some former wet (*qy.* rent?) so shattered that it scarce well supports the roof. The mullions of windows also are scaled by the rusting of the iron bars that are fixed in them, and some of the tracery work like to drop by the spreading of the walls.

"The cure proposed is, a brace of iron round each buttress, fixed to the bars which now are in the crooks, which need be 3 in. broad and 1 in. thick, and will weigh the whole eight, 2100 lb. at 6*d.* per lb. amounts to 51*l.*

"An iron band quite round the Chapter House on the top of the windows, of the same dimensions, will weigh 2500 lb. at 6*d.* per lb. = 62*l.* 10.

"Repairing the defective part of the timber work of roof, 10*l.*

"Repairing the walls between the vaulting and roof, new footing the butments where decayed' Restoring the mullions that are scaled and broken, and new pointing and keying of the walls and vaulting where rent, and all mason's work, 90*l.* Total 216*l.* 10."

So much for the only official document existing' The only portions of restoration which I can give Mr. Naish credit for having carried out, are as follows

1st. Rendering the iron ties more effective than they could have been when merely gutted in (although not done as he proposed)

2nd. Certain repairs to the feet of buttresses. Of all his other grounds of lamentation, I see no proof that they were attended to. The iron band round the head of the windows was never introduced. The defective parts of roof, of walling between the roof and the vaulting, and the tracery of the windows may have been repaired, but certainly not in a manner to do credit to Mr. Naish's constructive powers. I am at a loss to reconcile his assertion, "that without the eight iron ties, the vault could not stand *the least space of time*," with the current report that Sir Christopher Wren introduced these ties; seeing that the building must have been completed 400 years before Sir Christopher reported in 1669. How far it is probable that the author or authors of this beautiful design would have introduced so clumsy a means of support, (even if they had subsequently imagined their abutment weak) when they had under their eyes the "magic flying buttress" so lavishly used in the Cathedral, I leave the admirers of Gothic architecture to determine. In Sir Christopher Wren's report on the Cathedral and spire, there is not a word as to the Chapter House; an omission not very probable if he had felt it necessary to have recourse to such a remedy. They were probably introduced at a period previous to his, and consequently to Mr. Naish's report, when either the present injurious roof (or the high pitched one which I doubt not originally existed) may have exercised a far more dangerous effect in the central column than any thrust from the groin. I will now proceed to describe the state in which I have found this building.

The present roof is a flat one, rising to the level of the parapet, as at Wells and as at Lincoln (previous to 1800, when the high pitched roof was restored). It is covered with heavy lead, by no means in a weather-tight condition. The construction of the roof is of the most primitive order, and has exercised a very injurious effect on the walls and on the centre pillar. Its general effect is very much like that of an open umbrella. From the solid spandril on the centre column rises a heavy octagonal post of oak, 16 in. diameter and 17 or 18 ft. high, morticed into which are eight heavy beams about 12 in. square, taking their other bearing on the solid wall over the buttresses. These beams, which are 33 ft. long, are supported by bent braces of all sorts of form and substance. The outer ones, which spring from corbels very low down, and only just over the spandril of the groin, have rent the wall in some places, and have occasioned a considerable outward thrust. These braces have become twisted and decayed; some of them have got out of bearing, and have allowed the strain on the centre pillar to become most irregular. The space between these eight main beams which I have described, is filled with seven heavy timbers 12 in by 8 in most injudiciously applied, the outer ends bearing on a heavy plate about 4 ft. above the point of the window, the thrust from which has much shaken the wall and injured the tracery of the windows; the other ends are wedged and skew nailed into principal binders. Nothing can be more injudicious than this construction instead of throwing the weight of all these timbers on to the eight main beams, and so weighting the abutments, their load is thrown on the weakest part of the enclosing walls. The timbers are of oak and Baltic fir, indiscriminately mixed, and are generally in a pretty sound state.

The buttresses, which are of solid Chillmarke stone, are perfectly sound, and show hardly any symptom of decay or settlement; the intermediate walling is not so free from injury, the spaces below the windows showing indications of unequal settlement, from the greater mass and weight of the buttresses. The tracery of the windows is very much shaken, and the mullions have suffered considerably from the action of the weather and the corrosion of the iron bars. Internally the masonry is much injured, the exquisitely sculptured capitals, and the interesting series of scripture subjects commemorative of the life of Joseph having been shamefully mutilated by the Parliamentary Commissioners and their satellites, who quartered men and horses in these sacred buildings. The walls and niches bear evidence of having been highly decorated with colour and gilding, and there is still a strongly coloured ornament diverging from the bosses at the junction of the ribs. The stone seat running round the Chapter House originally occupied by the members of that body, is in a damp and perishing condition The encaustic tile paving which covers the whole space of the floor is in a very unsatisfactory state, the colour much faded, and where the concrete foundation is carried round the walls, and the central pier does not extend, it has sunk considerably below the original level. The windows have, alas, long lost the rich and glowing colours which, little doubt, originally added to the beauty of this exquisite room, the last remaining one having been taken down subsequent to Mr. Britton's survey in 1812. Although of the frailer material, wood, the old Chapter table (a most interesting relic) exists with less apparent injury and decay than even the walls which enclose it The Purbeck shafts and capitals in the interior are, curiously enough, more decayed than the Chillmarke stone ones.

The centre shaft, of Purbeck marble 1 ft. 6 in. diameter, surrounded with its eight smaller ones, 4½ in. diameter, from which springs the groin enclosing the room, is still in good preservation, though it has been thrust out of the perpendicular an extreme distance of 1⅜ in. to the east. The smaller shafts have perished considerably, and will require to be replaced with new stone. The simple groin which springs from this shaft has its ribs of Chillmarke stone, 2 ft. deep, and about 12 in. wide the intermediate groin being of chalk, 1 ft. thick, in the upper surface of which is a coating of fine concrete or mortar, the underside being plastered, and the joints of the stone marked upon it. I believe I have nothing to add to the description of its present state, and I now pass to the consideration of its restoration.

The removal of the iron bars to which I have already alluded, and which have a very prejudicial effect on the appearance of this room, was the first point to which my attention was directed, and this has naturally involved a difficult and anxious consideration, resolving itself however into this one point Whether the abutment now offered by the buttresses, with the additional power of resistance they will gain by the whole weight of the roof being thrown upon them, instead of being scattered over the whole enclosing walls, is sufficient to counteract the thrust of the groin itself; (for care will of course be taken that the new roof shall occasion no outward thrust). I was led to suppose that, in the Chapter Houses of similar form and construction to this one, as at York, Lincoln, Wells and Westminster, I might find prece-

dent of some kind. The inquiry has confirmed me in my previous belief, that the one at Salisbury was the lightest in construction of this class. At York, the groining to the Chapter House is not less deceptive than that to the nave and choir of the Cathedral itself, being of wood, in one span, of 57 ft. diameter. Till lately, it was enriched with painting and gilding; it has, unfortunately, of late years, been much injured by that worst vice in architecture, being made to assume the appearance of a material it really is not. It has been plastered and jointed and coloured in imitation of stone With a sort of prophetic dread of the march of desecration, the Rev. John Drake, one of the Prebendaries, presented a view in 1736, "lest time or other cause should destroy or deface this magnificent structure." The roof, which seems to be of very strange construction, almost without any attempt at the principle of continuous trussing, has at least the redeeming virtue of being held together by the tie beams. I have been unable to get an accurate section of this building, which, however, is not of much consequence, as it bears so little on the object of my inquiry. This Chapter House, which, I believe, was built in the early part of the 13th century, would probably have been a few years anterior to the Salisbury one. The child certainly was not unworthy of the parent. The Chapter House at Lincoln is not much more useful to me, the excess of strength in this case being more puzzling. The groin itself could never have required such buttresses, and we can only imagine that the original roof must have been constructed with some considerable degree of thrust, against which these immense flying buttresses were brought into play. The present high pitched roof, which was restored in 1800 (one of low pitch having usurped the place of its original one) must, if correct, occasion a considerable thrust. This Chapter House is a decagon of 60 ft. diameter, and is supposed to have been the first built in this country of polygonal form, a variation from the square and oblong, as at Bristol, Glos'ter, Durham, and Peterboro', supposed to have been suggested by the circular churches of the Knights Templars. The Temple Church being dedicated in 1185, being 15 years before the completion of the Lincoln Chapter House, Giraldus Cambriensis attributing it to Bishop Hugh, who died in 1200. It undoubtedly must be considered a very perfect work for so early an era. "St. Hugh was a native of Burgundy, and may have obtained artists or designs from his own country." That of Wells is an octagon of 57 ft. diameter, resting on a groined crypt, Its height is considerably less than that of Salisbury, but like it, the groin springs from a central column 3 ft. diameter, surrounded by 16 smaller shafts, just doubling the size of the centre shaft, and the number of smaller ones at Salisbury. At first sight, the great disproportion between the abutments of this Chapter House and that at Salisbury, seems unaccountable; but on referring to the plan of the groining, it will be found that this of Wells is much more elaborately groined, and that the proportion of the stone ribs is as 9 to 3, 9 ribs springing from each buttress at Wells, 3 from each at Salisbury, naturally adding considerably to the weight and thrust even if the intervening groin was not heavier. I am not aware of the material used for this purpose. I believe chalk is not a material found in that part of Somersetshire: it is in all probability of stone instead of the lighter material. And in these causes, I think, the apparent discrepancy between the abutments at Wells and Salisbury may be satisfactorily accounted for. I do not know the exact date of the building. In feature and general detail it is of the same century as those I have alluded to; although in all probability it is subsequent to them. Whether it has gained in effect by reduced height and lightness, I must leave to others to determine.

The Chapter House at Westminster, the last I shall speak of, is of octangular form, and was a "remarkable instance of lightness and richness of ornament." It was built in the reign of Henry III, probably about 1250. As at Wells there is a crypt, the groining of which is of excellent workmanship. I believe that this building, in its original form, must have more closely resembled the Salisbury one than any of those I have referred to; apparently of similar height and width, its groin was originally supported by a central shaft having eight smaller shafts surrounding it. The walls are not of greater thickness than those at Salisbury; and the projection of the buttresses (where the flying buttress was not introduced) is as nearly as possible the same as at Salisbury. These apply to those on the north-east, north-west, and two to the west, where the cloister joins it. What the character of the original stone groining was, I believe there is no history remaining. Nor is it known exactly how long the monks held it, but in 1377 the Parliament held their sittings there, the crown having undertaken its repairs (well fulfilled) and it was so used till 1547, when Edward VI gave St. Stephen's Chapel for this purpose. It was then occupied as a place of deposit for exchequer records. On the 4th March, 1705, the House of Lords memorialized the Queen (Anne) to have it put into repair, and this is stated to have been done soon afterwards by Sir Christopher Wren, though I know not where are the existing traces of such repair.

The springer of the groin still remains over the central shaft, and the boarded floor rests on the old encaustic tile.

With the exception of this last instance, my consideration of the polygonal Chapter Houses has led to little satisfactory result; and if it were not that I fancy there is to be traced in each, good cause for the variations we find, I might become a convert to Mr. Gwilt's belief: "That the investigation of the equilibrium of arches by the laws of statics, does not appear to have at all entered into the thoughts of the ancient architects; experience, imitation, and a sort of mechanical intuition, seem to have been their guides. They appear to have preferred positive solidity to nice balance: nor have they left us precept or clue to ascertain by what means they reached such heights of skill as their works exhibit." I think if Mr. Gwilt had remembered the Chapter Houses of Westminster and Salisbury, he would have made them exceptions to his rule, and have allowed that at least they have worked as close to "nice balance" as in these examples they could well do.

Having failed, then, to discover, in these works of similar form and coeval date, any positive rules which could be a guide in determining the question of sufficient abutment, I endeavoured to find, in the works of those who have written on the theory of arches, some actual rule which I could reduce to practise, applying to this case. In this search I have not been very successful. The works of Peyronnet, Rondelet, Gautier and other foreign writers on arches, apply generally to bridges and other forms of vaulting rather than to groining as practised by the early Gothic architects; and that their abutments would not apply in one case is not very surprising when it is remembered that "rib pointed vaulting," composed "*ex lapide et topho*," has invariably the actual rib thinner than the uniform thickness of the Roman vault; and that the panels of the groin (the principal part in superficial quantity) sometimes does not exceed one-ninth the rib in thickness. A reference to their sections shows how light is the construction of Lincoln and Salisbury Cathedral as compared with that of St. Paul's, so much vaunted for the mathematical science it is said to display. The naves of St. Paul and Lincoln are the same height and width; the piers of the towers are double the diameter of the shafts in the latter, and its continuous wall exceeds in thickness by one-half the wall and buttress of Lincoln. Nor have I found anything in the works of Ware, Hutton, Mosely, Gwilt and others, which actually bears on this case. In the work of Durand, an old French writer on arches, a curious problem is laid down to determine the abutment of an arch, which, if not based on the soundest laws of statics, is at least ingenious and plausible, adapting itself to every form of architecture; the French engineers, I am informed, rely upon it to a great degree. I was so pleased with its simplicity, that I determined to test it by an experiment on a large scale. Having to construct the clerestory wall of a church, which was 50 ft. high, to the wall plate, with semicircular arches springing from columns 2 ft. 3 in. diameter, at a height of 18 ft. 6 in. from the ground, and abutting against a pillar, (of the strength of which some doubts were entertained,) I had formed in brickwork, to a quarter the full size, an arch of this description, retaining only as an abutment the width which this problem gave. The arch was loaded (in proportion) to the full height of the 50 ft., and no deduction was made for the openings of the triforia or for the clerestory windows, which in the original, would much reduce the weight over the crown of the arch. This experiment was made in a foundation of very questionable nature; it was carried up in mortar, and the centres were struck within an hour or two of its completion. This arch stood perfectly, and until the period of its being taken down, some weeks afterwards showed no symptoms of weakness. Having more abutment than this problem called for, and taking into consideration the reduction of weight effected by the openings I have alluded to, the clerestory walls were completed, as originally intended, and stand perfectly. This, then, is the most theoretically practical rule I have found, and has confirmed me in the belief that the vault of this Chapter House, would stand perfectly with the abutment it has. It will be found that the width of the abutment, at the level of the springing, is in the case of Salisbury, about one-fourth the span of the groin itself. That at King's College Chapel, Cambridge, although of a much flatter and more thrusting arch, has the thickness of the abutment only 3¾ times the width of the arch.

Trinity Church, at Ely, has a stone vault of segmental form, which has the abutments only one-fifth of the span of the arch, that arch being of a very flat and thrusting form. Of these most complex theories of the arch, so seldom brought to bear on individual cases, and so seldom accordant, one is almost inclined to say with La Fontaine—

> "Quand on l'ignore, ce n'est rien,
> Quand on le sait, c'est peu de chose."

Unfortunately this discrepancy in theory extends itself to data given as the result of practice and actual experiment, and adds infinitely to the difficulty of arriving at anything like a satisfactory result in inquiries of this kind. As instances, I may state that Rondelet, a French writer of much celebrity, gives a force of 5000 lb. on the square inch, to crush a piece of oak, and upwards of 6000 lb. to crush fir; whereas Mr. George Rennie, in his elaborate and detailed experiments, found English oak to crush with 3860 lb. to the inch, and fir with 1928. The result of all experiments on wood, however, go to prove that the resistance increases in a much higher ratio than the mere area of the material.

Mr. Rennie found Portland stone to crush with 1284 lb. to the square inch. Messrs. Bramah, in their experiments in 1837, found 1020 lb. crush it; whilst a central stone shaft at Anjou Cathedral, which is considered a remarkable specimen of lightness, bears only 500 lb. to the square inch, though calculated by Mr. Gauthy to be equal to the resistance of 3470 lb. to the inch.

It is probable that few experiments were made actually on the same data, the stones are not of equal quality, the wood unequally seasoned; and when we remember that oak timber loses 30 per cent of its weight in seasoning, these differences are to some extent explained.

Believing that one sound practical opinion would avail more in this case than any theory, I have sought the opinion of those members of our profession, and of those of the engineers, in whose judgment on such points I have the greatest confidence, and they have without one exception confirmed my belief, that if the outward thrust of the roof is removed, these ties may be taken away. I had the benefit of the opinion of Captain Dennison, (Government Engineer at Woolwich,) who examined the whole building with me most carefully, and who fully concurs in this view of the question. We tested the upright lines of all the outer buttresses, and we found that with very little variation, they had all gone outwards, from the perpendicular, between 3½ and 4 in. to the springing line, even those immediately adjoining the staircase and cloister walls, where naturally the abutment is greatest; proving, as we think, that this must have been the effect of one uniform thrust, when the centres were first struck, and the whole groin took its bearing. We found the iron bars slack, hardly any of them being strongly in tension.

The centre pillar has gone over towards the east considerably, to the north-east 3⅞ in., to the east 4⅝ in., and to the south-east 3⅞ in., an injury we believed to have been much more caused by the irregular thrust of the heavy roof than by any action of a groin, which from its abutments having all equally decayed, must have been nearly "in equilibrio." The stone ribs show hardly any trace of the necessary contraction and expansion which must have taken place when this pillar went over; and the chalk groin shows no settlement that gives cause for alarm. Having then satisfied myself as far as possible of the practicability of removing these iron ties, we propose to shove up the centre column, these timbers having been brought to their bearing (the weight they have to carry being 115 tons). I propose to take down the present central shaft, with its eight surrounding ones, to plumb a perpendicular line from the centre of the octagonal stone above the capital, and from this centre to carry up, on the old foundation, the central pillar, making good, with Purbeck marble, such ones as may be found to have perished. This foundation is composed of concrete of the best description, and evidently laid before its reputed father, Sir R. Smirke, could have introduced it into this country. This effected, and the groin left to its proper bearing, (the iron ties still being untouched,) I propose to take off the present heavy roof, and in its place to substitute, as I strongly hope, the high pitched one, the feet of the principal rafters being laid into cast iron shoes, held together, or rather in their places by eight wrought iron tension rods, 1½ in. diameter, having an eye at the end nearest the centre, into which the suspension rod (thickened at its lower end to 3 in. diameter) would fall, and hold up the tension rods. This roof, if adopted, would render unnecessary the piece of timber now resting on the centre column. The sprandrils of the groin I propose to fill to the height shown by the red tint. That this was the original form of roof, I believe there can be little doubt, a view in which I have been confirmed by Mr. Pugin, who has carefully studied this Cathedral, and who speaks most confidently to the point; to suppose it otherwise, would be to imagine that in this building they had thrown overboard the vertical spirit of the Cathedral roof, and of all roofs of that size of which we have any trace. Having satisfied myself that the further perpendicular weight which would by this means be thrown on the buttresses, in addition to that of the groin, could have no crushing effect, the weight each buttress would have to carry being 62 tons, which distributed over the area of each, gives a weight of 59½ lb. to the square inch; whilst the capabilities of Chillmarke stone (taken at four-fifths the lowest given for Portland) would require 823 lb. to the inch to crush it. The centre shaft bears 1000 lb. to the square inch. Rondelet says "there can be no danger in making stone bear one-third the weight which would crush it;" it is therefore fair to suppose there can be none in giving it one-fourteenth; and in this calculation I have made no allowance for the increased tenacity afforded by an increase of superficies. This risk being avoided, the additional resistance thus afforded to the thrust of the groin by the weight above, would be considerable. Of the value of this heavy superstructure, Sir Christopher Wren was fully aware. In his report on Salisbury Cathedral, he says, "As for the vaults of the ailes, they are indeed supported on the outside by the buttresses, but inwardly they have no other stay but the pillars themselves, which as they are usually proportioned, if they stood alone without the weight above, could not resist the spreading of the ailes one minute."

Should, however, the Chapter (whose consent to any plan must be obtained) object to the high form of roof, and require the new one to retain the pitch of the present one, and not to rise above the parapet, their decision must be final, and in that case I should propose to adopt this roof, which though simple enough in its construction, has at least this advantage over its predecessor, that it causes no outward thrust.

In either case lead would form the covering. The roof being made perfect, and all defects in the external masonry having been made good, I propose gradually to loosen the nuts which are now attached to the iron ties, watching most carefully if any fresh thrust follows. Those bars I propose to re-introduce above the groin and immediately under the roof. They would form a perfect tie at this level, and if unluckily any accident or failing shall take place in the cast-iron shoes or tension rods of the roof truss, these bars would then come into play, and would prevent the effect of any lateral thrust. The internal stone work we hope gradually to restore. The stone seat and step running round the Chapter House will be taken up, cleaned and re-laid, making good with new stone. Under this seat, it is proposed to form a flue in brickwork, into which would be introduced from a stove, to be built under the stairs, a current of warm air, having vents through, and stone ornaments on each face of the octagon, thus keeping the building free from the damp which now disfigures it.

It is proposed to relay the whole floor (containing 236 yards) with encaustic tile paving, of similar design and colour to those now existing; and instead of their being laid on the earth as at present, which has tended to make the floor damp and irregular, I propose to have a thin bed of concrete made with water lime formed over the whole surface not occupied by the foundations.

The plastering to the soffit of the groin, which now exists, is in a defective state, cracked and discoloured. It will be repaired and recoloured; and as the chalk groin is of rude and irregular surface, it perhaps will be desirable to reline it as it now exists, restoring the present coloured ornaments which now diverge from the bosses.

I have now only to allude to the windows. It is years since the last window of stained glass existed in the Chapter House. It was then taken down and used in the restoration of some of the Cathedral windows. If there ever existed a building in which colour was an essential ingredient, it is this; and I have every confidence that if the restoration, to which I have already alluded, can be satisfactorily carried out, that it will not be a very distant period before these windows will be filled with glass, whose colours shall be not less rich and harmonious than those which originally decorated this interesting building.

Iron Ships.—"*The Iron Queen.*"—We find that iron, as a material for ship-building, is fast gaining ground. For steamers iron has been a favourite for some time past; and there is not now one wooden steamer building at this port, while we observe there are two iron ones, of the first class, nearly completed, and, we understand, contracts are made for the building of three more. We are also now satisfied, that the only objection to building vessels of iron, namely, the getting foul during a foreign voyage, is completely removed. This is proved by the result of two voyages of the *Iron Queen.* This barque, 350 tons register, left the river Tyne in February 1842, with 424 tons of coals for Havana; from thence she went to Mobile for a cargo of cotton for this port. She has now completed another voyage, from this port to Galveston, in Texas, carrying 300 tons of salt out, and a full cargo of cotton home. She has been in the Graving dock, where she was visited by many persons, and she is found not to have strained a single rivet, although she struck heavily on Galveston Bar. There is no appearance of corrosion, the red lead being fresh on the plates; and neither shells, barnacles, nor any foulness, was on her bottom. This desirable result is caused by the simple application of a compound of tallow, bright varnish, arsenic, and brimstone, which effectually destroys marine, vegetable, and animal substances. *The Iron Queen* was built by Messrs. John Vernon and Co., of Aberdeen, and has proved very creditable to their skill as builders. The surveyors for Lloyd's here are so well satisfied that there is no corrosion that they have classed her A. 1.—*Liverpool Albion.*

IMPROVEMENTS IN LIVERPOOL.

[The following observations by Mr. Rosson, were made upon a paper lately read at the Liverpool Polytechnic Society, by Mr Holme, on the improvement of 'Liverpool; we regret that we have not been able to obtain Mr. Holme's paper.]

Mr. Rosson said, that in compliance with the invitation of their respected president, he rose to make some observations on the very interesting paper just read by Mr Holme. Architecture had been one of his favorite private studies for the last twenty years, and he had often lamented, during that period, to see the little progress which this great commercial metropolis of the north-west of England has made in exhibiting good specimens of construction. This was the more remarkable, when the vast means of private individuals, and the funds placed at the disposal of the corporation, were taken into account. Reference had been made to the noble models of architecture left by the ancient Greeks, whose remains which had escaped destruction still excited the admiration of every traveller who looked upon them. The Parthenon, for instance. Let us inquire by what means that transcendant work of architectural genius was raised? Why, it was raised because Phidias, the prince of sculptors of antiquity, had a Pericles for a patron, and by the influence of the illustrious sculptor, Ictinus and Callicrates were employed as architects, though under the controul of Phidias. But, independently of the good fortune of the Athenians in having a Pericles to judge and guide them in the application of high art, the Greeks had a mode which he (Mr. R.) would strongly urge the people of Liverpool to adopt, now that public competition had become the rule to guide them in their choice of the artists who were to execute from time to time the works that were to adorn their great city. The practice among the ancient Greeks was to call upon a number of distinguished architects to send in designs by a certain day, and when they had all been exhibited, to leave to the artists themselves the choice of the one that was to bear away the palm. This was by giving each artist *two votes*, one in favour of *his own design*, and the other for the *one he thought the best* among the compositions of his rivals. The best of the whole always turned out to be the one approved by the majority of the *second votes*, as a reigning beauty, at a public ball, is always considered by every handsome girl in the room decidedly the handsomest present, *after herself*. (A laugh.) Thus the wisest of the people judged and appreciated artists, and artists themselves judged and appreciated each other, in the face of all Greece, assembled on great public festivals. And in modern times, a very remarkable instance of public justice occurred at Rome, in the pontificate of Benedict XIV. That distinguished pontiff invited a competition of designs for the improvement of the Piazza del Popolo, in which our, then, young countryman, the late Mr. Harrison, of Chester, entered the lists. The judges selected a Roman design; against the decision the famous Piranesi protested. His holiness caused the drawings to be re-examined. The consequence was that the judgment was reversed, and young Harrison received the gold medal. He (Mr. R.) lamented to say that that distinguished architect, the greatest since the days of Wren and Gwynne, chose afterwards to bury his fine talents in the little obscure city of Chester, instead of settling in London, and correcting the bad taste of Soane, Nash, and others. When a resident in the Temple, he (Mr. R.) had joined with his hon. friend, the member for Scarborough, Sir Frederick Trench, in the efforts made about fifteen years ago to construct the Thames Quay. The society, however, they then formed, though under the immediate protection of his late Royal Highness the Duke of York, and, indirectly, under that of the crown itself, could not accomplish their great object, though aided by many distinguished noblemen, gentlemen, and merchants, and by "the unaffected grace," and elegance, and talents, and powerful patronage of the late all-accomplished Duchess of Rutland. They, however, managed to erect some good buildings, amongst which must be named Stafford House, in the Stable-yard of St. James's Palace, the finest nobleman's town residence in the empire. He (Mr. R.) was cognizant of every stone laid in the construction of that edifice. The staircase, the finest thing in London was formed on the model of that of Versailles and the house, with the recent additions of the present noble proprietor, the Duke of Sutherland, formed decidedly the finest private palace ever erected in England. Finding, however, that public taste was not ripe for the quay, they intermitted their labours, as he observed, fifteen years ago, but he was happy to say that they had resumed them recently, with every expectation that, with the aid of the government, and the awakened taste of the age, and the labours of his friend Charles Barry, at Westminster, on the new Houses of Parliament—all these combined, he thought, would at length enable them to achieve the object of all their vows, and give a new character to the banks of the noblest river in our domestic empire. At the period referred to, when they (the committee) were busily engaged in their efforts, and publishing drawings, of which they were very proud, and were gradually drawing the attention of the London public, the elder Mr. D'Israeli entered their council-chamber, and astounded them with the information that they could not establish any claim to originality—that he held in his hand a book that set at rest and put the extinguisher upon all their claims as *exclusive authors* of the grand schemes they were projecting. He (Mr. R.) had referred to a "great unknown" of the name of Gwynne. Had any gentleman present ever heard of his name? He dared say not; and yet Gwynne was one of the greatest architects that this or any other country had ever produced; the book Mr. D'Israeli brought was the work of that illustrious architect, called "*London and Westminster Improved*," 1761 or 1763. Every public improvement that had been made in London or Westminster, during the last thirty years, was down in that book, with this especial difference, that Gwynne's designs are infinitely better, exhibited greater taste, elegance, judgment, imagination, and resources than the works actually carried into execution. For instance, a bridge was suggested in the very place where Waterloo Bridge now stands, under the name of "*George the Third's Bridge*," with approaches on each side the Thames, infinitely finer than those erected. Regent-street appears under the name, I think, of "*Great George-street*," with elevations much superior to those actually existing—the bold cornice, the stone balcony, the harmony of parts, the solidity, in fine, which all our streets want, were there to be found sketched, giving a new character to London as it then existed. But that great man, whose talents were appreciated by Edmund Burke, Dr. Johnson, and the great men of the Literary Club formed by the great lexicographer, had the misfortune to be born forty years too soon. The times were not germane to his labours, public taste, from want of education, was not ripe; and his work, which deserved immortality, and would have obtained it in a better age, fell, still-born, from the press. His name would almost have been lost, had it not been kept alive by a reference to him made by Boswell in his Life of Dr. Johnson. But to return to the improvements of our "dear native city," Liverpool—for, though not a city *in law*, she was a city *in fact*,—he (Mr. R.) entirely concurred with his friend Mr. Holme, in all the observations made in his very excellent lecture; but he must confess that when he came down to the bottom of South Castle-street, he was much disappointed and surprised to see him make a *back Somerset*, as it were, and avoid all mention of the *New* Custom-house. He (Mr. R.) never looked upon that building but with sorrow and disappointment—sorrow, that that erection completed the destruction of the finest inner harbour formed by nature in the kingdom (and in this he was confirmed by the opinion of the greatest engineer now living, whose name was another name for science in civil engineering), and disappointment, that so noble an opportunity of displaying architectural genius had been thrown away, by the erection of a building whose composition was full of bad architectural grammar, and whose vastness and solidity alone relieved it from absolute contempt. It was faulty in composition and in position, and its bad material excited the amazement of every one who knew that the vigilant jealousy of government was generally exercised with reference to the materials wherewith every specimen of architecture, civil or naval, was constructed. Look (said Mr. R.) at the basements of the columns. No geologist, deserving the name, would consider such material *stone*, but rather a *conglomerate* of sandstone in its primitive formation, full of cracks, and threatening to fall to pieces: the columns in *ten pieces*, instead of *two*. The joints will be the first part of the building to decay: posterity will have to replace them sooner than the present generation imagine. Walking round, you may almost thrust your thumb into holes filled up with clay and rosin! Alas! all this arose from irresponsibility, and the absence of competition. It was a bad thing for the architect himself. His (Mr. R's.) friend, Charles Barry, competed with all the rising talent of Britain both for the Houses of Parliament and the Reform Club-house,—the finest private palace, for its purpose, perhaps in Europe. To return to the Custom-house. In point of composition—the utter want of distribution of light in the rooms and corridors produced a "darkness visible," which, independently of its perpetual inconvenience in a place where so prodigious an amount of business is transacted, gave the whole the appearance of the gloomy chambers leading to the catacombs of the dead. Indeed, said Mr. R., I have long denominated it "The Tomb" of the inner harbour of the port of Liverpool. Mr. R. proceeded to say,—"I speak this in sorrow; but just censure is the tax which all public servants must pay, especially that portion of them who have been largely endowed by the public press, and have not returned their money's worth in public service." But he would now turn to a more pleasing subject. He begged to congratulate the society on the prospects before them. Liverpool had at length obtained the aid of an architect, whose talents were of a high order. He had been recently introduced to him in London—was delighted with his designs, and pleased to find him so young a man. Liverpool had nothing, as yet, but her *docks* to exhibit to the stranger: those would pass muster with the greatest engineers. But they had now to look forward to the erection of a *Place* (as the French called it) that would form the capital of the city, containing a street and courts of justice of surpassing beauty. That would be the era from which posterity would date the commencement of an architectural style worthy of the second commercial city in the empire; and, consequently, in the world; and he felt justly proud, encouraged, and animated by the approaching triumph.

BLASTING OF THE ABBOT'S CLIFF AT DOVER.

Another of those remarkable engineering operations which have already attracted the public attention, in connexion with the South Eastern Railway, took place on Tuesday, April 18th, at a distance of about three miles to the westward of the town of Dover. In order to afford an outlet to the Abbot's Cliff Tunnel, and a platform on which the rail could be laid down between that and the Shakspeare tunnel, it became necessary to remove a portion of the projecting cliff. From the success that had attended former operations of the kind, and especially the recent blast at Rounddown Cliff, it was resolved to remove it by the aid of gunpowder.

The surface of the cliff acted upon by this explosion lay to the westward of the Rounddown Cliff, and its remaining cliff forms the face of the terminus of Abbot's Cliff tunnel. It extended 300 feet in length, and the height of that portion which was directly acted upon was 200 feet. The object of the operation was to slice off, as it were, a large portion of this surface, so as to make that which was before rugged and uneven, and which projected far too much in the way of the proposed line along the side of the cliff, perfectly flat and smooth, and fit to afford a sufficient platform for the road to be laid down upon, and to prepare the terminus of the tunnel. The "slice" to be removed varied in thickness, according to the extent to which the surface projected beyond that which would be convenient to the operations; at some points it was 60 feet, and at others 30 feet, and the quantity of powder introduced at the different parts was, therefore, proportioned to the thickness of cliff to be removed, regulated, of course, by the degree of resistance which, from the greater or less nearness of the surface to the chambers in which the powder was deposited, would be offered to the action of the powder. The quantity of powder in each chamber was calculated according to the line of least resistance. Cubing the line of least resistance, one-half the number of feet is the number of ounces of powder used. The arrangements made for the introduction of the powder and the simultaneous ignition (if possible) of the different charges were simple, and, at the same time, ingenious in the extreme. There were altogether 100 barrels of powder, or 10,000 lb. This quantity was distributed in various proportions in 15 different chambers, at nearly equal distances. To form these chambers the rock was perforated at those nearly equal distances, and the different proportions of powder were introduced on Saturday last, and "tamped up" close. There were two separate lines of these chambers of powder, and therefore two series of charges; one being near the top of the cliff, about 200 feet from the summit, the other about 100 feet lower down. Thus a space of about 150 feet from the bottom of the cliff remained altogether untouched by the explosion, that being required as a platform for the road to run upon at the entrance of the tunnel. The apparatus for igniting these different charges was placed to the eastward, about 2000 feet from the nearest, and about 500 feet from the furthest chamber. It consisted of six batteries of 20 plates each, and by an ingenious invention of Mr. Hodges, the assistant to Mr. Wright, the resident engineer of the line from Ashford to Dover, they were all fired simultaneously. Simple as the invention is, it is not so easy to describe it on paper. Suppose a triangular skeleton chair; what would be the seat of it is suspended by a common string at the distance of about an inch or more from a framework beneath (resting on the legs of the chair), in which are fixed the batteries and connecting wires. Immediately under the string which suspends the other portion of the battery is placed a circular trough, in which there is a "blue" light. Through this light is passed a fuse, 12 feet long, and taking some minutes to burn down. This fuse was fired by Mr. Hodges, who had time to get away from the spot before the string was burnt. The moment the string was severed by the flame, down went the upper framework, the voltaic action was performed, and the electric fluid communicated to the wires. These wires were two, one for the upper, the other for the lower range of chambers, each extending the whole length of the surface to be operated upon, and attached to them were other supplementary wires communicating with the chambers of powder. The ends of these additional wires were of course formed in the usual way, with a piece of platina wire affixed, which on being made red hot by the electric fluid ignited the gunpowder in what are called the bursting charges—small portions of powder in cases surrounding the ends of these wires, which again immediately fired the larger quantities of powder contained in the different chambers.

Thus within a few moments after the ignition of the blue light, the upper framework of the skeleton chair above described fell down, the voltaic action was completed, and in almost an equal period of time the explosion was effected. And yet how remote to all appearance the connection between the burning of a short piece of string (a foot long) and the fall of that immense mass of cliff!

The operations at the Rounddown cliff were carried on under the advice of General Pasley and Lieutenant Hutchinson, who also took a great interest in the proceedings on the present occasion; but the whole of the arrangements for the explosion of to-day were under the controul of Mr Wright, the engineer, assisted by Mr. Hodges, as already mentioned. As far as the practical effect of the operation was concerned all was successful; but as a mere sight the affair was unfortunate, in consequence of the thick fog that hung over the cliff, and made it impossible to see the actual fall.

At 4 o'clock, the hour appointed for the blast, many thousand persons were collected to witness it, but the thick fog obscured all. I took a boat, and approached as near to the shore as was allowed, but could see no more than the crumbling mass falling down into the water beneath with a sound resembling the roar of artillery heard at a distance, and the noise of the surge breaking on the sea shore. In respect of the noise created, this explosion differed from that at the Rounddown Cliff. There no noise whatever was to be heard, or scarcely any, and the mass of rock glided almost silently into the sea like a mighty wave; but in the Abbot's Cliff blast there was much more noise, and it was more prolonged.

Those who were on the cliff were sensible of a shock a few moments before the detached portions of the cliff fell. Explosion is an inappropriate term to use; for, in fact, as far as hearing is concerned, there is nothing of the sort;—the operation of the powder is internal, and the effect only known by the fall of the fragments. Mr Hodges, the assistant engineer, fired the fuse in connection with the battery. He had four minutes in which to get away, but had calculated that he could run down the ladder in two and a half. He was the last person who left the range of the batteries.

Beside the multitude of persons collected on the cliffs and on the adjacent shore, the sea was covered with boats of all sizes and shapes. There were also two large steam-boats filled with visitors.

Although in consequence of the thick fog or mist the spectators were deprived of much of the gratification which such a sight would have afforded, the operation, in a scientific point of view, was held to be decidedly successful. All the chambers of powder were ignited simultaneously (or nearly so), and the immense mass of disturbed chalk and earth fell slowly and equably into the sea. The exact results, however, cannot of course yet be ascertained.—*Times*.

ROYAL ACADEMY.

Professor Cockerell's Lectures on Architecture.

(From the Athenæum.)

Lecture VI, and last.

Proportion, and the application of its golden rules, as they affect the external forms of architecture, had occupied the latter part of the preceding lecture; the *αναλογια* of the Greeks, delivered to us by Vitruvius, that analogy, by which all the conformations of artificial bodies were derived from natural bodies, seemed to be a principle of obvious importance and utility to the architect, and should be attentively considered.

It appeared that the animal kingdom furnishes clearer lights for our guidance than the vegetable, because organized nature was more constant in her proportions, and enabled us always to re-establish the whole from a part; thus the hand of a Grecian statue, of the Hercules, the Apollo, or of the Venus, or a fragment of any one of the Grecian orders of architecture, enabled us to restore the whole, indeed, the proportion by aliquot parts by a modulus, a principle of the Greeks, as explained by Vitruvius, lib. i. c. 11, lib. iii, c. 1, was still practised in India, and seems founded in organized nature.

Not so in the productions of the vegetable kingdom, fragments of which would never enable us to comprehend the whole: however indebted to this part of the creation for the graces of ornament, and various essential analogies, architecture found a less sure guide of proportion in this than in the animal kingdom. in fact, all architecture so derived was anomalous, as the Egyptian and the Gothic, in which no fixed laws of proportion have ever been applied or attempted. Columns or supports might be from five to fifty diameters in height, and were only bounded by possibility. The stunted pollard, the spreading cedar of Lebanon, the aspiring poplar, or the attenuated cane, were extremes equally at the disposal of the architect.

But that guide, which the face of nature furnished to the architect for his external forms and proportions, was wanting for the internal—as of areas, squares, courts, and open places; or of internal capacities (height as well as area); as of temples, halls, apartments, &c.; in these we must appeal to the relations of reason, purpose, and convention.

Vitruvius (lib. vi. c. 2, 3, 4, 6, lib. v. c. 1, and c. 2.) gives us the experience of the ancients on this important subject. The Greek forum, says he was a square, but the Roman was three by two, because the gladiatorial, shows were exhibited there; courts should have the proportions of five by three (the favourite of the learned Palladio), sometimes three by two, or sesquialteral, or the diagonal of the square will be the length. He lays down the proportions of all the apartments of the Greek and Roman house: atria, alæ, tablinium, and peristylium, triclinia, œci, exedræ et pinacothecæ. He does not, however, establish any *principle*, and his rules are wholly empirical. But the great Alberti, not content without a principle, adopts the Pythagorean doctrine of universal harmony, and agreement between sounds and numbers, namely, that what pleases the ear pleases also the eye; he lays

down, therefore, his harmonic proportion, in which Blondel, Ouvrard and others have followed. The notion of musical proportions is common, and has occupied many ingenious minds already versed in that art. Describing St. Peter's, Byron, in this feeling, observes

> Vastness which grows, but grows to *harmonize*,
> All *musical* in its immensities.

Alberti was the first also to establish the rules of arithmetical and geometrical proportions (lib. ix. b. 3, 4, 5, 6), applied to all the varieties of areas and capacities. He is followed by Palladio in the arithmetical and geometrical rules, lib. i. c. 23.

It is a comfortable conclusion to the practical architect that the empirical rules of Vitruvius, the harmonic, the geometrical and arithmetical rules of Alberti and his followers, agree in the main, so that either may be adopted without material deviation from correctness; but the neglect of these rules, in which lie that hidden charm that every one must be sensible of when examining a finely proportioned room, has been common of late years, as if the principle were of no value; the zealous student therefore should carefully note that consent of the ancients and the most illustrious masters of the moderns, here set forth; and he will soon learn devoutly to repeat the denunciation of the Hindu Vitruvius (Ram Raz, Asiatic Society, 1834, p. 15), "Woe to them who dwell in a house not built according to the proportions of symmetry."

It is true, that the climate of this country and our habits do not often permit the finer Italian proportions; thus the arithmetical rule of proportion, common with our greatest masters, in our best mansions, 36 by 24, should give us 30 feet high to the vault, but we commonly limit it to 18 feet. To correct the defect of lowness, so frequent with us, the illusions of perspective painting, after the admirable Pozzo, may well apply; but even the arrangement of the trabeation and plaster enrichments, offer to the ingenious architect, versed in perspective, many resources for the increase of the apparent height, and for the attainment of an artificial proportion. But a manufacturing people are prone to carpets, rugs, curtains, gilded frames, and mahogany furniture, while the low ceiling is a sheet of paper stretched like a drum, at most of a neutral tint, of indurated fog, with a gilt moulding: while the artistic Italian opens a window of perspective in his ceiling, through which a canopy of poetry and distance delights the eye, and deceives the understanding; but the floor is paved with tiles.

Again, in our modern churches, a ceiling, 60 by 80, has often been fearlessly stretched in one unbroken surface of plaster, in defiance of the fine examples of Charles's and Queen Anne's churches, in which a cove, after the Italian manner, has the effect of reducing the ceiling, and of rectifying the proportion in the simplest and most graceful manner. The student should well reflect on this important field for architectural skill and effect. He may be a good builder and cheap, but he can have no pretensions as an artist who throws away his time and his character in such condescensions as this mechanical employment of his talent implies.

The rules hitherto referred to, have the beautiful for their object. Beauty in architecture depends, amongst other causes, especially on the exact and graceful proportions of the parts and of the whole. But the sublime depends upon other causes, in which rules cannot prescribe; to the latter not only the rules of the former do not apply, but they are destructive of it. If the beautiful resides in the proportionate, it would appear that the sublime often resides in the disproportionate. The principles and the rules of beauty and sublimity are distinct. If we stand under an arch of London Bridge, the vaulted soffite, so vast and extended, sustained from such distant abutments, produces a kind of sublime; no doubt aided by its comparative lowness. The Pantheon is inscribed in a cube, its height equal to its diameter, no one standing under its prodigious cupola has ever denied its sublimity. But when that same Pantheon is raised into the air on equal dimensions at St. Peter's, it may have become beautiful, but has lost its quality of sublime. When Byron apostrophizes the Pantheon, he feels the peculiarity of its merit.—

> Simple, erect, severe, austere, sublime,
> Shrine of all saints, and temple of all gods
> From Jove to Jesus, spared and blest by Time
> Looking tranquillity!

As the dome of the Pantheon is raised at St. Peter's into a proportionate height, at the expense of its sublime, so the nave (nearly twice as wide as that of St. Paul's Cathedral), also raised proportionately, loses all effect of magnitude; and the common and universal observation is, that as respects this important effect the architect has laboured in vain; and the work stands self-condemned.

The noble poet coincides with the received opinion, and is obliged to supply by poetical moonshine that dignity and interest which it was his object to give to the Vatican. He says—

> Enter: its grandeur overwhelms you not,
> And why? it is not lessened; but thy mind,
> Expanded by the genius of the spot,
> Has grown colossal, and can only find
> A fit abode wherein appear enshrined,
> Thy hopes of immortality!

Sometimes this failure has been attributed to its proportion, which (from its justness, it is said) takes from its magnitude; a criticism at once the most severe and just that can be. In fact, no increase of a proportionate object will ever give it magnitude and the sublime; these depend on extraordinary relation and excess of parts and proportions.

Some years ago a French giant, upwards of nine feet high, exhibited himself in London, but so just were his proportions that no one would give credit to his dimension, till they stood beside him; he was therefore accounted a kind of fraud, and the exhibition failed. But had he been disproportioned, his head small, his shoulders high, and his members excessive, he might have succeeded, even had he been a foot shorter. Had the nave of St. Peter's, 77 feet wide, been 90 feet high only, instead of 115; or if we were to suppose a stage raised mid-height and place ourselves upon it, we should be sensible of its vast latitude, and the effect of magnitude would have been produced as under a bridge. The Barriere de l'Etoile, from the same reasons, though as large as the front of Notre Dame—the arch itself 48 by 95, equal to the height of the nave, but of ordinary proportions and great simplicity of parts and members—loses its effect; the *arc monstre* is glorious to the *grande armée*, but not to the arts of their day; and is infinitely less artificial in its combination that the arches of St. Martin and St. Antoine, designed by the accomplished Blondel.

If, then, the architect can obtain latitude, he should seek to carry out its effect by quadrate and comparatively low proportions; but if he adds altitude to his latitude, he loses his expense and pains, and he may find too late that half his dimension might have attained the same effect; since *proportionate magnitude* defeats itself.

But as extreme latitude gives the sublime, so does its opposite extreme of altitude: in Cologne and Beauvais, the naves of which are three and a half diameters in height, though scarcely more than half the actual width of St. Peter's nave—limited, therefore, in their dimension to the usual cathedral width, yet nearly double the usual proportion—the sublime is completely attained, and disproportion again appears to be the efficient cause.

But the optical consideration of the visual angle in which these several proportions present themselves is exceedingly important. Thus to the spectator of the dome of the Pantheon, the visual angle is 95°, while the same dome raised into the air at St. Peter's is only 30°. In the nave of St. Peter's, the visual angle is 18°, that of St. Paul's Cathedral is 37°, while the vault of Cologne is only 22°. Since then the effect of magnitude is measured by the number of degrees in the visual angle, the architect will advert to this consideration as of extreme interest.

We come, then, to the important conclusion, that the sublime and the beautiful are to be found in the proper adjustment of proportions, rather than in dimensions; and we may infer, that no increase of scale to the beautiful will ever make it the sublime.

But the sublime is of rare occurrence; the use, however, to which these reflections may be turned by the practical architect under limited means, is remarkably illustrated in the Casino at Chiswick, where the very circumscribed area of the rooms is compensated by their extraordinary height, and the accomplished Lord Burlington has given a nobility to very small apartments which no one could believe on seeing the plan alone without visiting that elegant work.

Magnitude is the great object and result of design, and this quality is only to be attained by the fine adjustment of relative proportions in magnitude and order. Architecture consists in magnitude and order (says Aristotle), το γαρ καλον εν μεγεθει και ταξει εστι. (Poet. p. xi. s. 4.) The works of man, compared with those of nature, display our insignificance. The pyramids, seen in the clear sky of Egypt, or St. Peter's at Rome, are proverbially disappointing to the first gaze of the beholder: it is only after he has instituted comparisons and admeasurements that he becomes sensible of the greatness of these human efforts—and his memory will supply him with many instances in which objects of very inferior dimensions have surpassed them in impression of magnitude upon his mind. It is plain, therefore, that art alone can produce the full effect of magnitude, and to this the architect should direct all his skill: the ancients will be found consummate masters in this as well as in every other department of our art. It is, indeed, a fine art which enables the accomplished artist to raise ideas of magnitude and grandeur of composition on a piece of paper no bigger than your hand; while a less able one shall cover a vast canvas without executing any comparable notions. Worthy of all inquiry and solicitude is such an art, for it is the whole art of design and proportion. Pliny cites a statue of Hercules, so small that it might be lifted by the hand, which, however, conveyed more grandeur, magnitude, and strength to the mind of the observer, than a Colossus would have done. How great must have been the science of the master! and if, with such small means, he could affect the mind with these impressions, how great the economy of cost and material to the employer!

Burke, whose notions, however, of proportion are vague and erroneous, says admirably on this point (sec. x.)—"A true artist should put a generous deceit on the spectators, and effect the noblest designs by easy methods. Designs which are vast only by their dimensions, are always the sign of a common and low imagination."

In the last lecture it was attempted to show that magnitude, breadth, and proportion of parts were best found in inequalities; but the consideration of magnitude, as respects composition of the whole, seems to depend on other principles: first, it appears that, to make a great whole, there must be many parts; secondly, to appreciate that whole, the point from which it is permitted to be seen should be eusynoptic, namely, so contrived as to fill the

angle of vision of 60·0, and occupy the whole retina with multiplied impressions fairly and agreeably presented.

With reference to the first proposition, it may be observed, that in a young tree bursting from the ground, two or three branches with upward tendency grow from the polished bark; the subdivisions are few, and we may count the leaves. By and bye, with age and maturity, the bark becomes rough and corrugated, the base is surrounded with excrescences and roots, which, partly above the ground, indicate the hold it has on all the surrounding space; the branches now shoot out at right angles with the bulky stem, each limb becomes a tree, the subdivisions of these are infinite, and, in all degrees of size and proportion, the leaves are countless. So the young animal, simple in parts, and smooth, expanding with age and strength, develops features and subordinate parts never dreamt of before; furnished and complete, the measure and fullness of strength and beauty is at length filled up. So in architecture, the tetra-style portico can never look large, though, in St. Peter's, the columns have eight feet in diameter. The Hecatompedon, burnt by the Persians, was not inferior in the scale of its parts to the present Parthenon, but Ictinus judged that, by increasing the number of parts—making that octo-style which had been hexa-style only—greater magnificence would result.

The temple of the giants, at Agrigentum (hepta-style) was the largest Doric of antiquity, but to give it all its value, a number of new features, never seen before, accompany its increased growth and vastness. It is raised on a platform of many steps, a base of novel design surrounds the columns, and these vast masses themselves, each a tower of thirteen feet in diameter, built of many stones, told by its many parts and its elaborate construction the cost and grandeur of the undertaking. So the columns at Pestum have twenty-four instead of the usual twenty flutings; in short, examples are infinite to show that, to convey the full effect of real magnitude, an artificial magnitude must be superadded, or it is lost labour.

Gradation and repetition of features of the same general resemblance in various sizes, the major and the minor, are main sources of magnitude; the artist will see, in the satellites surrounding the planet Jupiter, the best reason for the title of the Father of the Gods; the western towers of St. Paul's give magnitude to the dome. The same principle was to have been applied to St. Peter's, but the western towers fell down. In the admirable church of the Salute at Venice, the minor dome over the high altar, and again the stil smaller towers accompanying this, are foils to the great dome. Byron admirably enforces the number of parts:—

" Thou seest not all; but piecemeal thou must break,
To separate contemplation the great whole;
And as the ocean many bays will make,
That ask the eye—so here condense thy soul
To more immediate objects, and controul
Thy thoughts, until thy mind hath got by heart
Its eloquent proportions, and unroll
In mighty graduations, part by part,
The glory which at once upon thee did not dart."

Childe Harold, c. iv, v. 157

So Palladio (as already remarked) characterized his style by the interpenetration of the larger order by a smaller.

In decoration we are careful to put a small scroll in juxta-position to the larger, to give its full effect; and so the painter, to give size to his principal figures, interposes women and children in various gradations; the wreath or swag which shall contain flowers or fruit, all of the same size, will be mean, or look like a string of onions; the whole secret of proportion and whole purpose of magnificence is attained, by satellites, and by gradation of the major and the minor.

With reference to the second proposition, the consideration of the point of view of architectural works, the ancients, as has been already observed, were consummate masters, and cannot be too carefully studied. The labour of the architect is vain, if he miscalculates the point of view, and the picture which he is to present on the retina of the spectator. As well might the painter consent to a bad light for his work, as the architect be careless on this point. The *genius loci* will insist upon a peculiar composition; each position requires its own adaptation; we should have proper things in proper places. A design good in one place may fail in another, and the unskilful approach and point of view may ruin the best scheme. It is not enough to be right, but to show that you are so: the "*faire valoir*" is a fine economy which runs through the architecture of life, as well as of every step in brick and mortar. The architect must be well versed in this part of optics: the synoptic, the eusynoptic, the *deceptio visus*, shou'd be his constant observation; like a skilful general he must manage and manœuvre his masses to impose upon the spectator, and by their skilful disposition he may often gain that ascendancy which his real forces may not warrant. A familiar instance of this is seen at St. Paul's, and often practised upon the green-horn mason, who visits London for the first time. Of the two orders which decorate the exterior, the lower one forms the great order of the interior, in the same precise dimension; but the angle of view in the interior being so much larger, the spectator is persuaded of its larger dimension. The roguish cicerone engages the novice in dispute on this question, enforced by a bet, which on proof is always to his disadvantage and the penalty of his pot of beer.

Sometimes accident does more for us than wit. St. Paul's, constrained, and crowded amidst narrow streets, produces on the unsophisticated a magnitude and interest which would be lost if the pedants had their way, and large areas and terraces were to expose it from Farringdon Street and the Thames.

While considering magnitude, we must not forget that (the most difficult of all) which arises from greatness of conception—a quality which every one habituated to contemplate fine buildings, must often have been impressed with. But much more the ingenious architect, who in his practice has had opportunities of comparing his own design with those of others more able than himself, and still more in canvassing the various modes in which a work might be performed, will remark the difference between one mind and another. He will find all the moral qualities of the artist exhibited in his performance. "By their works ye shall know them;" greatness of soul, or contractedness of spirit, a folly or a vice, the specious, the clumsy, the refined, the honest, are written in characters quite legible to those who have learnt to decipher the language of design.

We might show the character of Wren in the lineaments of his work—sublime in his mathematical attainments, clear, original and comprehensive in his combinations above all men; but in his exterior unobtrusive and timid, small and elaborate, concealing the art (as Nature does) revealed only on our nearer examination to our wonder and delight. We plainly see "the Nestor of Athens, not only in his profession the greatest man of that age, but who had given more proof of it than any other man ever did; he was in a manner the inventor of the use of mechanical powers; and they record of him that he was so prodigiously exact, that, for experiment's sake, he built an edifice of great beauty, and seeming strength, but so contrived as to bear only its own weight—so that it fell with no other pressure than the settling of a *Wren*! But such was Nestor's modesty, that his art and skill were soon disregarded, for want of that manner with which men of the world support and assert the merit of their own performances, and for want of that natural freedom and audacity, necessary in the commerce of life, his personal modesty overthrew all his public actions."—Parentalia, p. 341.

In the works of Jones we see the beautiful and specious, the sensual beauty of the tasteful artist, but no mathematics, no sublime combinations of structure, but generous, and free, and highly ornamental, we discover the director of the masques of the splendid court of the Stuarts—the "Marquis Would-be."

In Vanbrugh we have the dramatist throughout; his theatre and scenery are everywhere, imposing with a pompous grandiose, the spectator is at first captivated, till he peeps behind the scene, and the illusion vanishes.

In short, it is plain that the architect must have moral as well as intellectual qualities, to acquit himself duly of the high charge intrusted to him; and no argument can more effectually convince the student, that in ordering his studies he must first order his own character and conduct; and that nothing can come from him of great and noble, unless from a pure fountain and a well-regulated stream. We must endeavour to sustain that rank in society which both sacred and classical antiquity have assigned to the architect (see Isaiah, c. iii. v. 1, 2, 3; and Cic. Off. p. 12.)

But an important principle in the æsthetical as well as in the real ends and purposes of our art is solidity, the result of equilibrium between the forces of gravity. Nothing can be beautiful which is not strong, or is not adequately strong for its purpose. The impression of duration is indispensable to that satisfaction and repose which the mind seeks in a well-ordered work of architecture. According to the simple notions of the ancients, it was the essence of the grandiose and beautiful. The temple of the eternal was to breathe the spirit of eternity,—strong in its entire structure, it was to be strong also in its component parts, its "great stones." Energy, mental and physical, and stability, were the expressions most desired in architecture; voids were to be above voids, solids above solids; the area even of the supports, and the incumbent weight (orthographically considered) in most instances of the finest temples are, or approach to, equality.

To this end the whole composition of the edifice was pyramidal, the sides being inclined (as has already been observed) in every style of architecture known to us. The quoins and piers of the angles which inclose the work are larger than those towards the centre; and we may be sure that the expression of strength and duration given to a building is often of itself sufficient for beauty, without other adventitious ornament; as we may also be certain that the want of this quality cannot be repaired by any expedient which the architect may apply. In fact, the qualities of solidity and equipoise impose on the understanding the same awe and conviction with reason, justice, and truth; as inspiring that security, stability, and peace, without which all is flimsy conceit and vain ambition.

But this rational propensity is sometimes in jeopardy from the love of the marvellous and the exhibition of skill in the artificer, from whom, while we deprecate the hazard, we cannot withhold our applause; and if assured, either by the nature of the material or the quality of the structure, of the security the mind demands, we are easily reconciled to the wonder. But this temptation is often a severe trial to the ambitious architect; and without a sober taste, chastened by modesty and reason, it may be often more than he can resist.

We delight in the suspended arch of a bridge or in the enormous vault which covers the Pantheon, or the baths of Caracalla, or the Temple of Peace. We are reconciled to those of the Gothic cathedral, so long as their stone props or buttresses continue to perform their duty. Not so in the grove at the east end of Salisbury Cathedral, which, like the banyan tree, seems to be composed of pendants from the roof, in different dimensions,

rather than columns to support it; beautiful, indeed, but so fragile that the blow of a stick or the movement of an awkward visitor would put the whole fabric in peril. If, instead of a friable stone or marble, these shafts were made of brass, the mind would relapse into that security which is ever the first requirement of our art.

The love of the marvellous is dangerous; exaggeration is the first sign of a mind indifferent to the value and beauty and sufficiency of truth, and the surest sign of depravation of judgment. Truth must ever be the best foundation of taste, and can alone be constant and enduring—

Rien n'est beau que le vrai; le vrai seul est aimable!
Il doit regner partout, et même dans la Fable.
De toute fiction, l'adroite fausseté,
Ne tend qu'à faire aux yeux briller la vérité.
Boileau, Ep. ix., v. 43.

The Egyptian, the Roman, and sometimes the Greek, indulged in the gigantic, with a view to the expression of a prodigious energy. But the middle ages were prone to the marvellous, surprise was the great scope of the Gothic architect. Æsthetics were not, indeed, likely to have been studied under the education to which the mind at that time had access. Miracles infatuated the understanding; superstition was the foundation; a dominant hierarchy was little communicative of the lights of science it possessed. The poetical vein received its chief aliment from the east; our scholars brought home from Cordova the Arabian taste for excess and hyperbole. The chastening counsel of a Locke, a Newton, or a Bacon, were wanting to regulate that exuberant and uncultured fancy, and that enterprising skill which the practical experiments in building promoted at so much cost and zeal in those ages.

The two styles of building, till the 15th century, were termed *more Romano*, in semi-circular arches, which followed the old basilica model of St. Peter's and St. Paul's, and *more Germano*, in which the pointed arch was employed after the 13th century; it was in the latter taste that the greatest works were executed.

However great and admirable, in many respects, the specimens which have been left us by those able practitioners, it is not believed by the most competent judges that theoretical science was cultivated to any extent. From Cesare Cesariano, the architect of Milan cathedral, and one of the earliest translators of Vitruvius, doubtless one of the most learned architects of his day (1524), we may learn something of the principles which guided the middle ages, which were full of the mystical terms of the pseudo-science of the Freemasons. They consisted of a series of triangles or pyramids, no doubt in allusion to the triune, which guided the plan, elevation, and section; see D'Agencourt's architecture, plate 46, in which the sections of Milan and Bologna cathedrals illustrate those doctrines. The minster at Bath appears to have been built after this theory (1503) by Dr. Oliver King, who was a skilful architect and politician, and had been employed in France to conclude a peace with Charles VIII., and who, therefore, would be acquainted with the most approved art of that day on the continent.

The middle age church was wholly founded on superstitious associations. According to *more Romano*, it was enough that the plan described the cross, the universal symbol in "hoc vince." But according to *more Germano*, the Saviour himself was to be figured; the choir, therefore, was inclined to the south, to signify, that "he bowed his head and gave up the ghost." John, c. xx, v. 30; and there are few cathedrals in which this deflection is not remarkable. The nave represents the body, and the side, which "one of the soldiers pierced," (John, xix. 34), considered to be the south as the region of the heart, is occupied at Wells by a chantrey, at Winchester with the chapel of William of Wyckham, and is constantly the pulpit from which the faithful were reminded "to look on him whom they had pierced," Zech. xii. 10 who "was wounded for our transgressions," Isa. liii. 5 For the same reason the south was considered the most holy the Old Testament was represented on that side, while the New Testament, and the local or national Hagiology, was placed to the north. The same superstition still gives value to the south side of the churchyard for burial. At the head of the cross was the chapel of the Virgin, at the Fountain of Intercession with her son. At the foot, the west end, was the "Parvis," supposed by some to be a corruption of "Paradis," that happy station from which the devout might contemplate the glory of the fabric, which was chiefly illustrated in this front and from whence they might scan the great sculptured picture, the calendar for unlearned men, as illustrative of Christian doctrine and of the temporal history of the Church under its princes and its prelates. Three great niches leading into the church, the centre one often above forty feet wide, were adorned with the statues of the apostles and holy men, who "marshal us the way that we should go," in front the genealogy of Christ, the Final Judgment, the History of the Patriarchs, &c.

The details, indeed, display the degraded state of the fine arts, and of course, of the artists themselves, in the quaintness and disproportion of the sculpture. But extending our indulgence *to* the performers, regarded in illiberal times only as workmen, we shall admire their native genius, struggling with their moral condition, often on the verge of dignity and grace in execution, and in point of conception frequently reaching an elevation altogether original. It must be confessed that the continental churches, especially those of Amiens, Rheims, and Paris, surpass the magnificence of our own cathedrals, both in the extent of plan by their double ailes, as well as by their height. But it may be questioned whether a more complete and correct picture of Christian doctrine and dispensation, [illegible] Christian history, is to be found anywhere than in Wells Cathedral.

But the same want of cultivated judgment which is apparent in the æsthetical of the arts of the middle ages, is traced also in the imperfection of their statics and stereotomy, in which again solidity is sacrificed to superstition. The indispensable figure of the cross is a striking example. The arches of the nave in the northern basilica, found their abutment abundantly in the western termination, which was commonly fortified by prominent buttresses (called by the early commentators of Vitruvius, tetra-style, or hexa-style, according to their number); but at their eastern termination, towards the lofty pillar of the transept, no such abutment existed. And though the pointed arch was eminently calculated to obviate lateral pressure, yet the smallest failure of foundation or superstructure, threw so much weight against these pillars as to occasion them to bend. To counteract this, and secure their stability, the principle of that age, of "pondus addit robur," namely, the weighting the pillars of the transept with a tower or spire, was resorted to very commonly; but this often increasing the evil, the last disfiguring remedy, the construction of a reversed arch between them, was employed.

Similar criticisms apply to all parts of the middle age architecture, mixed, however, with redeeming excellencies of peculiar skill hitherto unsurpassed.—See sections 1 to 8 of Wren's surveys, in the "Parentalia," 264 to 309.

The fifth of those principles of Vitruvius, which the Professor had attempted to illustrate, was Decor, usually considered to refer to that important part of architecture, ornament; but our author rather appeared to refer to consistency of character, fitness of style and ornament to the Deity, and the purpose or the rank to which the work might be dedicated, quoted in the preceding lecture. But as no part of the art required a nicer judgment, tact, and reasoning than this of character and special physiognomy, so was none more commonly transgressed in many modern buildings; and a stranger might be conducted to some of them, and defied to guess whether he beheld a library or a town hall, a church or a music room, a theatre, a prison, a brewhouse, or a floor-cloth manufactory, a gentleman's mansion or a union workhouse.

Appropriateness and fitness of character is the special recommendation of all the great critics, from Aristotle to Pope. If, says Horace, to a horse's neck a human head is joined, or a female head and breast should terminate in a fish, you will despise the painter; or if upon the stage you exhibit the graces and the levities of youth, bashed up with the manly strength of middle life or the rigour of old age, the audience would yawn, and at length overwhelm you with indignant hisses. It is, in fact, the significance and appropriateness resulting from the coincidence of use and beauty, the one the explanation and plain result of the other, which we adore in the works of Nature, and which the great artists have best known how to imitate in theirs.

Sir C. Wren remarks on the Temple of Peace—"It was not, therefore, unskilfulness in the architect, that made him choose this flat kind of aspect for his temple; it was his wit and judgment. Each deity had a peculiar gesture, face, and dress hieroglyphically proper to it, as their stories were but morals involved; and not only their altars and sacrifices were mystical, but the very forms of their temples. No language, no poetry can so describe Peace, and the effects of it in men's minds, as the design of this temple naturally paints it, without any affectation of the allegory. It is easy of access, and open, carries an humble front, but embraces wide; is luminous and pleasant, and content with an internal greatness, despises an invidious appearance of all that height it might otherwise boast of; but rather, fortifying itself on every side, rests secure on a square and ample basis." On the Temple of War, he says, "As studiously as the aspect of the Temple of Peace was contrived in allusion to Peace and its attributes, so is this of Mars appropriated to War; a strong and stately temple shows itself forward, and that it might not lose any of its bulk, a vast wall of near 100 feet high is placed behind it; (because, as Vitruvius notes, things appear less in the open air;) and though it be a single wall, erected chiefly to add glory to the fabric, and to muster up at once a terrible front of trophies and statues, which stand here in double ranks, yet an ingenious use is made of it, to obscure two irregular entrances," &c.

The German Moller, who is as true and as accomplished an artist as any of modern times, on this point says, "On comparing the elevation of the Merchants' Guildhouse, at Mentz, with the church of Oppenheim, which was finished in the same year, we see how anxious the ancients were, and how well they contrived to impart to every building its peculiar character. Just as the merit of historical painting, and of every art of design, (without which all the rest is valueless,) consists in the importance and peculiarity of its character, so they are principal requisites in buildings, whenever the latter lay claim to the appellation of works of art. In the church at Oppenheim, all the parts are lightly towering up, so that the eye of the spectator in the interior is involuntarily raised, and the elevated richly ornamented windows, and slender aspiring pillars, promise from the outside already a beautiful and sublime interior. But in the Merchants' Guildhouse, the whole exterior announces at once an object very different from that of a church. The few and small windows are easily closed against fire and robbers; and their battlements again, with their projecting canopies and angular enrichments, clearly show that the destination of the building is to preserve and to protect. And in the same way as the main forms correspond with the object of the structure, so likewise do the ingeniously designed orna-

ments. On the pinnacles or battlements are the figures of the emperors and electors in full armour. The emperor, who, at that time in alliance with the electors, had confirmed the commercial union of the cities on the Rhine, and taken them under his protection, appears with them here, as the guardian and bulwark of the house. In the midst of the princes, is the figure of St. Martin, the patron of the city, dividing his cloak with his sword, to give it to the poor. Thus, the leading forms announce the destination and solidity of the building; the figures of the princes, the protection it enjoys; St. Martin, that beneficence which ought to be the attendant of wealth; and the Virgin Mary with the infant Jesus, over the entrance, the higher safeguard which the Divinity grants only to the *just*." Thus says the accomplished Moller.

It is a fine observation of Aristotle, that "a noble building without ornament is like a healthy man in indigence." Competence, if not wealth, must be added for the accomplishment of his happiness.

The sculptor's art affords the noblest ornaments to the architect. By his aid, the expression which he has been labouring to give by other associations, and which before was mute, or scarcely audible, becomes *parlant*. Sculpture may be called the voice of architecture. Unhappily a Protestant country, with the holy fear of image-worship, discourages this generous and most essential art; and perhaps the want of character complained of in architecture may be mainly attributed to this proscription.

But the carver and the decorator are highly serviceable to the architect, not only as multiplying images for the delight of the eye and the explanation of the subject, but as greatly magnifying the scale of the whole by these means, and giving value and distinction to the plainer features. Our mistress Nature is prodigal in ornament, and the expression of every animal and vegetable is increased by a texture of endless detail spread over the whole surface of her works.

Finally, Distributio, the *οικονομια* of the Greeks, the sixth principle, is explained by Vitruvius, drily, as economy in the use and cost of materials: but doubtless the great masters from whom he borrowed, considered economy, in the larger sense, as the adjustment of means to the end; as the wise and fine thought, contrivance, and supply, of all the requirements and appliances of the building art; in which the highest intelligence is displayed: such, indeed, as by that figure of speech which designates great subjects by small titles, applies to the *Creator* himself that of the great architect.

The diligent observer of architectural works will find the greatest strength combined with the least material, beauty united with use, and resulting from it, exact equilibrium, provisions for the accidents of time and climate, selection of materials best adapted, in short, a prescience of every want and consideration: throughout the contrivance admiration almost sublime is occasioned; we feel that the work has, as it were, been self-created by the influences and the wisdom of nature, and as if the architect had only followed her instructions. "I am not," says the heifer of Myron, "the work of Myron—he only delivered me from the marble" in which I was inclosed.

Having thus reviewed the theoretical rules handed down by Vitruvius from the Greeks, as far as the limits and means permitted, the Professor proceeded to offer some observations to the students, with reference to their future advancement, which it was the object of these lectures, and the ardent wish of the members of the academy to promote.

First, with respect to drawing, which was the very language of the art, it was extremely important that the distinction between the painter and the architect should be clearly understood. He deprecated the vain ambition of making pretty drawings, especially on a small scale, as effeminate and uninstructive; as also of pretensions to aerial perspective, which was a separate art. Much time was commonly occupied in this captivating study, which was wholly irrelevant, and at the expense of that valuable time which should be employed in the more essential accomplishments of the art and science. It might, indeed, improve the hand, but not the head; of which the architect had so much need. Drawing after the manner of painters had undoubtedly been an abuse and misdirection.

The orthographic drawing or elevation was conventional it represented the proposed building from an immeasurable distance—the object being to define those proportions and profiles which constitute the merit of the work—such lights and shades as should more clearly display these forms, and show their relief where necessary; but whatever disturbed these paramount objects, as colour, or such cast shades as might confuse the profiles and pretend to illusion, were impertinent.

Perspective, in the most accurate delineation, was, indeed, a most desirable accomplishment, but it should be wholly linear, assisted with one tone, or two at most. Sciography should be used with great reserve, since the harsh outlines of cast shades were apt to disturb the form and outline; and the finest architectural perspectives, those of Pozzo especially, left them softened and undefined on this account. It was certain that such had been the practice of the great Italian masters, specimens of which, by the hands of Sansovino, (the front of Sta. Maria, at Florence, in the possession of Woodburn,) of Michael Angelo, Raphael, and others, and especially the designs for Whitehall, by Inigo Jones, the Professor had exhibited in a former course. Exquisite perspective, proportion, and profile were more scientific, difficult, and much more profitable to the student. The coloured picturesque was a pandering to a depraved taste, and it was a duty to inform the public on this head, and lead them to the appreciation of the true intent of architectural delineation. The draftsman should be habituated to a large scale, and a manly drawing of profile and detail, such as a builder would comprehend and work from. The Professor exhibited a specimen of the architectural drawing of the actual school in Paris, which, though not wholly to be approved, as being rather too minute and elaborate in effect, still showed a more careful attention to outline, and a better system than used by ourselves.

The architectural room in the annual exhibition was at great disadvantage in the neighbourhood of the splendours of the sister art; the vain attempt at vying with her productions in architectural drawings, had both corrupted our style and exposed the utter futility of the attempt. The true course would be a closer adherence to the province of the architect in a more correct delineation of profile and proportion, and in the most accurate linear perspective; a tasteful employment of these resources would probably more effectually uphold the interest of that room than any other means that could be devised.

Constant observation and travel were essential to the architect; but the interesting objects of our own country should be seen before those of others. Much time was often lost in foreign travel by misdirection and the dangerous novelty of the student's position.

In examining architectural works, the student should bear in mind an important rule of criticism, which was, to account in precise terms, for the motives of approbation or dislike which he might experience. By applying a just expression on all occasions, he would soon cease to take one thing for another—the beautiful for the sublime—quantity for quality—cost for magnificence—and either of these for proportion or fitness—ornament for art. He would learn to apply characteristic terms to every gradation, quality, and style: and so, by degrees, he would form a just and discriminating taste.

In an art and science essentially referable to association, this discrimination was peculiarly necessary: the emotions arising from sight, like those from music, would often be found irrespective of the intrinsic merit of the performance, as loyalty in hearing "God save the Queen," union and patriotism in the "Marseillaise." Often patriotic, historical, and romantic associations will blind us to forms and styles, otherwise both unfit and unworthy our age; often quantity, extent, and quality of material would impose that approbation which ought only to be accorded to elegant and just proportions; elaboration would often usurp the praise which was due only to a well-ordered work.

To hide by ornament the want of art,

should not deceive the experienced critic; and the painter, "who would make his Venus *fine*, not knowing how to make her *beautiful*," would be ranked as he deserved. The discernment of merits rather than defects will be found more difficult, and much more profitable, because those we shall appropriate, while the latter are only to be rejected. Such a habit will exercise the better qualities of the mind, and lead to originality. The works of men who have long enjoyed reputation, should be the peculiar objects of our critical examination; they will seldom be found frauds; the inquiry will commonly justify their fame, and like the conversations of original inventors, they will reveal secrets which can else hardly be discovered.

The antiquary should be distinguished from the architect, and he should be careful to separate the available experience, from research into the curious and obsolete.

The student was recommended especially to cultivate that manly independence of mind which became a thinker, and the leader of an art; he should have a settled distrust of fashion; although he would find himself sometimes constrained in some measure to bend to it. Those "who live to please, must please to live;" he should, however, courageously but respectfully remonstrate.

There were two rocks, which the art was expressly liable to: the first was the presumption of absolute novelty; the second, the indolent and servile imitation of former styles. The latter was the peculiar vice of these times throughout all the civilized countries of Europe. Grecian, Gothic, Byzantine, Italian, Revival, French, were indifferently employed. There was no attempt at a style which should express to future ages the century in which we live; and posterity will be at a loss to recognize in the buildings of our day, that character which a country great and glorious at the present period, the bulwark of civilization, the arbiter of the world, and the great exemplar of political government, morals, and useful science, should impress upon its architectural productions. Shall it be said that this great people, original and free in other respects, adapting and expanding itself in an unexampled manner to times and improvements, was stationary, or rather retrogade, in the arts alone? That though science and capital and mechanical skill were daily furnishing new engines for our art, with prodigality, that our invention alone in these walks of genius was at a stand? that our skill as artists was the only deficiency in the march of our age? That they crudely adapted the models of ancient Greece to modern London, the sunny palaces of Italy to the foggy atmosphere of England. the niched and canopied architecture of a religion peopled with images of saints and martyrs, sibyls, angels, and holy men, to a Protestant religion, which, admitting none of these, must leave the niches and the canopies *tenantless*: like well-guilt frames adorning an apartment, the *pictures* being omitted: the pride and pomp of heraldry, armorial shields and crests, to an age in which chivalry was exploded, and quarterings had dwindled to insignificance? What should we say of Harry the Sixth, if, instead of that admirable and most original chapel of King's College, at Cambridge, he had limited his artists to the style of the Conqueror, or any other imitation; or if Henry the Seventh had concluded on carrying on the style of the cathedral of Henry the Third, and so on, saving

all further trouble of invention and criticism, should we not contemn their poverty of spirit and negation of mind? Would not the historian, the artist, and the tasteful observer, have to deplore the absence of that internal evidence and hieroglyphic character of the times, which adds such a relish to the architectural remains of our fair and beloved country?

But let us suppose that either of these monarchs had been enlightened by the art of a Raphael or a Michael Angelo, or by the sculptures of a Phidias, which he might even affect to appreciate and to be proud of; and that we should learn by historical record that he had said—"We are so anxious to carry out the style of former days that we shall shut our eyes to those excellencies of sculpture and of fine art, and force our artists to copy the obscenities and senseless carvings of those barbarous times; simply that we may carry out the imitation of the style in all respects."

Restoration, indeed, is a different consideration, and the happiest result of this taste is, that we reinstate, for centuries to come, those venerable antiquities to which we have so many reasons of attachment. The restoration of the Palace at Westminster may find under this consideration a sufficient apology. But for works altogether new such a system of imitation is not reconcileable with our pretensions to genius and enlightenment; and it does appear that there is in it a vice of mind or of industry for which posterity will visit us. Such an indifference as to choice of styles indicates, in fact, an absence of culture and perception of the really fit, and beautiful, and great—a state of mind which, in religion, politics, or morals, would be accounted fatal to improvement, and the sure forerunner of every heresy. D'Agencourt attributes to this spirit of imitation under the Emperor Hadrian the decline of taste in Rome.

The learned in Paris deplore it not only under this apprehension, but as the imposition of anachronisms on posterity, and as the falsification of the pages of history, in its most interesting and characteristic traits. "Have we not," as says Isaiah, "a lie in our right hand?"

It is very important that the merits of that question should be debated in a candid spirit, and that the true grounds of a style should be investigated by the rules of sound criticism; as how far architecture has ever been and should be the picture in which all the discoveries of mechanics, of materials and of industry, are to be exhibited and recorded; and whether the successive changes of style have not been chiefly owing to the progressive discoveries and improvements on workmanship, materials, and convenience. How far the combinations of this art are capable of displaying the intellectual character of an age and people, and what should be the just bounds and limits of association, authority, and imitation.

Finally, let us never forget the pregnant saying of the great Schiller:—

The artist is the son of his time;
Happy for him if he is not its pupil;
And happier still if not its favourite.

In conclusion, the Professor expressed the gratification he had felt in the attention paid by the students to this course of lectures; not as it reflected upon himself personally, but as it gave the strongest possible evidence of the ardour and assiduity with which they pursued their studies: for he could with great sincerity assure them that, amongst the achievements of a very long period of singleness and devotion to his profession, he should consider that the most glorious, which had contributed to the instruction, and warmed the enthusiasm of those rising talents destined perhaps in future times to adorn and illustrate our country.

INSTITUTION OF CIVIL ENGINEERS.

Feb. 7.—The PRESIDENT in the Chair.

"*Description of a Drawbridge at Barcombe Creek, near Kingsbridge, Devon.*" By George Clarisse Dobson, Assoc. Inst. C.E.

This drawbridge spans one of five openings in a stone bridge, built across a navigable branch of Salcombe Harbour: it is in one leaf, 15 ft. 9 in. wide, and 32 ft. long, from out to out, supported upon a cast iron shaft or axle, placed 7 ft. 6 in. from the inner end, working in the abutment pier, which is built hollow to receive it, and thus the part within the axle end acts as a counter weight. To the centre of the end cross-beam of the counter part, a chain is attached, and after passing over cast iron sheaves in the masonry of the face of the abutment, is coiled on a drum fixed on a horizontal shaft, carrying on one end a pinion, worked by a rack, attached to the piston of the hydraulic press; by this means, motion is given to the shaft and drum, and consequently to the leaf of the bridge. Balance boxes are hung to the counter end, by which the shutting is regulated. The struts for supporting the leaf, when raised, are also thrown in and out of their places by a rack and pinion. The hydraulic press used for opening and closing the bridge, is simple in its construction, and the whole works so easily, that a female can open and close the bridge in about 15 minutes without difficulty. The fresh water used for the pump is contained in a cistern beneath, and seldom wants replenishing, as it is returned into the reservoir every time after being used. The bridge was designed and erected by Mr J. M. Rendel, about 12 years since, when he was engaged in improving the turnpike road in the south of Devon. The expense of repairing, oiling, packing, &c., since its erection, has averaged under 7*l.* per annum, including a small salary to a neighbouring millwright for occasional inspection. The communication is accompanied by a drawing, showing a plan and sectional elevation of the bridge and the machinery.

ON FRICTION.

"*An Investigation of the comparative loss by Friction, in beam and direct action Steam Engines.*" By William Pole, Assoc. Inst. C.E.

In consequence of the comparatively recent introduction of direct action steam engines on board the steam vessels of the Royal Navy, the attention of engineers has been drawn to the advantages or disadvantages they possess, when viewed in comparison with those constructed with side levers. The object of this paper is to investigate the value of an apparently formidable objection which has been frequently urged against the direct action engine, namely, "that from the more oblique action, consequent upon the shortness of the connecting rod, the loss by the increase of friction is so considerable as to constitute a serious objection to this form of engine." After explaining to what extent mathematical analysis is applicable for determining the amount of friction, the paper proceeds to show that it may be satisfactorily used in the present case, as it is only the friction caused by the strain, or load, which is involved in the objection, and this is more adapted for theoretical than experimental determination.

The three general laws of friction, as established by the best experiments, are.

1st. That the friction caused by one solid body rubbing upon another, is independent of the velocity with which the rubbing surface moves.

2nd. It is also independent of the area of the rubbing surface.

3rd. It is proportional to the pressure upon this surface.[1]

From these it will follow, that if the pressure upon a moving body be multiplied by a certain co-efficient of friction (whose value is dependent upon the nature of the rubbing surface), the product will be the resistance from friction: and this multiplied again into any space the rubbing surface moves through, will give the amount of "power, work, or labouring force," expended in overcoming the friction through that space.[2] If the pressure upon the moving body be variable throughout its motion, the differential calculus must be employed, but the principle of calculation is still the same.[3]

The paper proceeds to deduce general mathematical expressions for the amount of friction on each bearing of an engine, by finding, first, by ordinary statical rules, the pressure thrown on each particular bearing by a given force applied to the piston, and then combining this with the space through which the rubbing surface moves. This is done for the beam engine, and for three modifications of the direct action engine. Equations are also added for the oscillating or vibrating engine, and for an arrangement in which the connecting rod is supposed to be indefinitely lengthened. The numerical values of the expressions for friction thus found, are then calculated for an engine upon each of these different constructions, supposing them to be similar in all other respects, having the cylinders 66 inches in diameter, with a length of stroke of 6 feet; and the results are shown in a table, distinguishing the friction of every bearing. From this it appears that as respects the friction caused by the strain, if the beam engine be taken as the standard of comparison—

The vibrating engine	has a gain of	1·1	per cent
The direct action engine with slides	loss	1·8	„
Ditto with rollers	gain	0·8	„
Ditto with a parallel motion	gain	1·3	„

This difference being so trifling, it is contended that the objection to the direct action engine, on the ground of its alleged increased friction, has, when investigated, no adequate foundation.

Mr. Field believed that the paper was correct in its view of the comparative amount of friction of the two kinds of engines. He was of opinion that an excessive allowance for friction had hitherto been generally made in calculating their effective power. It was found practically, that when the pressure upon the piston was about 12 lb. per square inch, the friction did not amount to more than 1 lb. or 1½ lb. per square inch. This was easily ascertained by the indicator, when the engine was working without a load, but when loaded, he knew of no accurate experimental mode of showing it. At the engines of the Blackwall railway, the experiment had frequently been tried, by casting off all the load, and so regulating the steam, that the engines should make only the regular number of strokes per minute; the result had invariably shown about 1 lb. per square inch for friction.

Mr. Taylor confirmed the preceding remarks; it had been the custom formerly in large pumping engines to allow one-fifth for friction, but modern practice had shown that this was not necessary, particularly since greater precision had been introduced into the construction of all kinds of machinery.

Mr. Miller agreed that the friction of engines generally had been over-

[1] Poisson, Traité de Mécanique, 2nd edition, art. 456.

[2] If m = the co-efficient of friction, P = the pressure, and S = the space moved through, then the power expended = mPS.

[3] Let x be any space moved through: let X represent the variable pressure, expressed in terms of x, then the power expended = $m\int X\,dx$.

rated; he believed that as a simple comparison of the friction of the main parts of two kinds of engines, the results arrived at in the paper might be received as correct; but there were several other questions which must be considered, if it was intended to establish a general comparison between the beam and the direct action engines; this, however, he believed was not the intention of the author.

Mr. Murray contended that the second proposition in the paper, which assumed that "friction was independent of the area of the rubbing surface," although supported by Coulomb and the early experimenters, had been proved by Vince and others to be incorrect; it was natural to suppose that in proportion to the hardness and smoothness of bodies, there would exist a different ratio for the best proportion of surface to weight for every different body; if a surface carrying a given weight was of less than the due area, the surfaces would cut into each other, become rough, and thus increase the friction; on the other hand, if the surfaces were unduly enlarged, there must be a loss from the additional amount of friction caused by the extended surface. He conceived that the calculations in the paper must be affected by the incorrectness of the data upon which they were based. The simple mode of comparing the beam engine with the direct action engine appeared to be, to suppose two engines of the same length of stroke and diameter of cylinder; the proportions being good, it would be indifferent whether the power was transmitted through a direct connecting rod or through side levers, the cylinders, air pump, arrangement of parallel motion, &c., being supposed to be alike, the friction of these parts would be alike in all cases, and the comparison would be limited to the parts employed in transmitting the power from the piston rod cross head to the crank pin; both connecting rods have the same number of bearings, which in both cases travel with friction over nearly the same distances: it is allowed that the bearings of the shorter connecting rod have a larger amount of friction, and that from the greater angle it assumes, more friction is thrown upon all the bearings of the parallel motion, on account of the greater force required to retain the piston in a vertical position. To counterbalance the increased friction on these parts of the direct acting engine, allowance must be made in the beam engine for the friction of the beam centres and of the top and bottom necks of the side rods. The friction being directly as the distance moved through, and the distance in the side rod ends being so very small, it follows that the amount of friction must be very trifling. The distance travelled by the beam centres is greater, but it is not of importance, as it is the angular distance due to the vibration of the beam, measured on the circumference of the gudgeon. Under these considerations Mr. Murray was disposed to give the preference (if any existed) to the side lever engine. In a pamphlet[4] published in 1840, by Mr. John Seaward, it is stated that four-fifths of the whole friction of an engine were absorbed by the packings of the piston and air-pump bucket, by the slide valves and by the different packings or glands; consequently one fifth was due to the whole of the necks or bearings throughout the engine. Now on considering the large proportion of this amount of the friction that is due to the bearings of the main shafts, of the crank pin, and of the bottom end of the connecting rod, and of all those other bearings common to both sorts of engines, it must be evident that the total amount of the friction due to those parts in which a difference between the engines exists, must be but a small portion of this one-fifth. Taking one-tenth or ten per cent. of the whole power of an engine, as the amount of power required to overcome the friction of the engine itself, which was allowed to be ample, one-fifth of this would be two per cent., and therefore the degree in which either engine could surpass the other in the amount of friction, could only be, as already stated, a small portion of this two per cent. In comparing the efficiency of these engines, it would thus appear that neither could be said to possess advantages over the other, as regards friction, in such a degree as to be appreciable in practice, or to render the point of importance in a choice between the engines; and that if the one kind of engine had advantages over the other, they must arise from other causes than difference in friction. Having taken this view of the case with a supposed side lever engine, of the same length of stroke and diameter of cylinder as the direct action engine, if manufacturers varied in a slight degree from this proportion, it was for the purpose of obtaining a better proportion of stroke and diameter of cylinder, and consequently a better engine than the one supposed to exist for the purpose of making the observations.

Mr. Vignoles looked upon the second proposition assumed by the author, as being overthrown by the results of the experiments of Wood and others, as to the ratio of friction to the area of rubbing surface; and it was well known practically, that the application of various unctuous substances materially altered the amount of the friction. A certain proportion was requisite between the area of the surface exposed to the friction and the pressure upon it, to bring it within the general law. For practical purposes, he submitted that the law should be received with limitations.

Mr. Gravatt said, that even allowing, for the sake of argument, that the second proposition assumed by the author was incorrect, still as the paper was only a theoretical examination of the comparative friction of those parts of two kinds of engines, which were most subjected to strain, supposing them both to be of similar power and dimensions, equally well proportioned and constructed, and the same sort of lubrication of the bearings employed, he would contend that the circumstances being equal, equal results would be obtained, and that the conclusions arrived at by the author should be received as correct.

Mr. Pole observed, that the objections brought forward were important, as they referred principally to the fundamental laws of friction. He would first give some explanation respecting the communication itself. The investigation was commenced at the request of his late friend Mr. Samuel Seaward; it was originally intended to have especial reference to the Gorgon engine, but had subsequently been extended to others. The paper, necessarily containing much mathematical reasoning, could only be read in abstract, and might, therefore, have been partially misunderstood, both as to its objects and results. The object was, not to enter into a discussion of the whole question of the respective merits or defects of beam and direct action engines, but simply to ascertain the value of the one objection named.

The whole friction of an engine at work with its load upon it, might be divided into two distinct parts. 1st. The friction due to the engine itself, or such as would be produced by the working of the engine, if unloaded. 2nd. The additional friction caused by the strain consequent upon the load; for it must be evident that when the engine had its work upon it, the friction upon the bearings through which the strain passed, must be increased, and additional friction produced, beyond that which would exist when the engine was working without a load. The latter of these alone required to be calculated, and to this mathematical analysis was more peculiarly adapted. The friction of the engine unloaded, might be ascertained by the indicator, as described by Mr. Field; but as he had remarked, there was no practical method of finding what was the additional friction when the load was applied; indeed, it would be as difficult to find the latter by experiment as the former by theory.

He then explained the manner in which the amount of friction upon each bearing had been calculated, and engines of different constructions compared with each other. He had adopted precisely the plan suggested by Mr. Murray, namely, by taking engines of the same length of stroke and diameter of cylinder, supposing them to be equally well proportioned and constructed, and in equally good condition. But instead of assuming, as Mr. Murray had done, that there was somewhat more or less friction on any particular bearing, his object had been to ascertain what was its actual value. If it were impossible to measure the pressures and spaces moved through, an approximation might be received; but since these quantities were ascertainable, it was more satisfactory to obtain results deduced from them. The conclusions drawn from the paper accorded, however, with Mr. Murray's, viz. that "neither construction could be said to possess advantages over the other, in such a degree as to be appreciable in practice, so as to render the point of importance in a choice between them." The difference between Mr. Murray's process and that in the paper, was, that what the former only assumed, the latter endeavoured to prove.

Mr. John Seaward's pamphlet on the Gorgon engine had been referred to. The conclusions he there drew were more favourable to the direct action engine, but were derived, like Mr. Murray's, merely from approximate consideration, rather than from strict investigation. Mr. Seaward confessed, that the friction caused by the strain was difficult to be calculated, and had therefore contented himself with assuming, that those gudgeons through which the strain passed, had three times as much friction as was due to the others. He also assumed that the friction was proportional to the area of the rubbing surface, a principle which no experiments had ever shown. On these grounds, it was contended that Mr. Seaward's results were open to objection.

Mr. Pole then proceeded to notice the objections urged against the fundamental laws of friction which he had stated, and to give authorities for them. The first of these had not been questioned since the days of Vince, by whom it was proved; it might therefore be considered as established. With regard to the second and third, it must be noticed that they depended, in some measure, upon each other, for it could be proved that if the third was true, the second must be true also. The principal experiments which had been made upon the friction of solids, were those by Amontons, in 1699; Coulomb, in 1779; Vince, in 1781; Wood, in 1818; Rennie, in 1828; and Morin, in 1831, 32, and 33. Amontons was the first who devoted any considerable attention to the subject, and he found that friction was not augmented by an increase of surface, but only by an increase of pressure.[5] Coulomb's researches were more elaborate, the experiments were on a large scale, and were submitted to a great variety of trials; they fully proved that the friction was proportional to the pressure, and that the extent of surface did not affect it.[6] These results were further confirmed by the experiments of De la Hire, Ximenes, Boistard, Rondelet, and others. Mr. George Rennie's experiments were very valuable, as having been conducted on a large scale, and with much care; they were also of a comparatively recent date. The results were conclusive on the point in question, for he found that when the surfaces were to each other as 6·22 : 1, the friction remained the same,[7] and one of the general conclusions he deduced was, "that the amount of friction was as the pressure directly, without regard to surface, time, or velocity."[8] The last and most extensive series of experiments were those by M. Morin; they were conducted at Metz, by order of the French government, and ex-

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[4] "Description of the engines on board the *Gorgon* and *Cyclops* steam frigates, with remarks on the comparative advantages of long and short connecting rods, and long and short stroke engines." By J. Seaward. London, 1840.

[5] Vide Phil. Trans., 1829, p. 145.

[6] Mem. des Savans Etrangers, 1781. Vide also Ency. Brit. New Edit., Art. Mechanics.

[7] Phil. Trans. 1829, p. 156.

[8] Ibid. p. 170.

tended over a period of three years (1831, 1832, and 1833), no expense or trouble having been spared to render them conclusive and satisfactory.[9] The results were given by Professor Moseley, in his new work on the mechanical principles of engineering.[10] They proved that "the friction of any two surfaces was directly proportioned to the force with which they were pressed perpendicularly together," and that "the amount of friction was, in every case, wholly independent of the extent of the surfaces of contact."[11] The before mentioned experiments all agreed, that the friction was proportional to the pressure, and was independent of the extent of surface. In opposition, however, to these, stood the experiments of Professor Vince, of Cambridge,[12] which led him to the conclusion that the friction increased in a less ratio than the pressure, and that it was not altogether independent of the area of surface. These experiments were probably conducted with care and accuracy; but it was also probable that equal precision had been used in those which proved the contrary; and if this was allowed, the majority of coinciding experiments might, as in all other cases, be safely received in preference to one dissentient. But if the particulars of Professor Vince's experiments were examined, many circumstances appeared which would render them less worthy of regard than others. It was not shown that he experimented upon metals, but that he used pieces of wood, either bare or covered with paper, and the experiments were on a small scale, the moving bodies being at the utmost a few ounces weight; while Coulomb, Rennie, and Morin, had extended their trials to all kinds of materials, and had used considerable weights. Professor Vince himself, although satisfied with the method of conducting his experiments, did not seem equally so with their results, as regarded the influence of surface and pressure, for he had remarked, "that no general rule could be established to determine it, even for the same body."

Quotations were then given from Gregory, Brewster, and others, corroborating this view of the inconclusive and unsatisfactory nature of Vince's experiments. The law of the influence of pressure and surface upon friction, was occasionally modified by accidental circumstances, two of which might be noticed, as they had been expressly treated of by Rennie and Morin.

1. It was only applicable within the limit of pressure which would not injure and abrade the surfaces; for when heating and undue attrition commenced, it was natural that the law would not hold good. Well-constructed machinery, however, was never supposed to pass this limit, and therefore this cause of irregularity might be rejected in calculation.

2. Another modification was produced by the application of unguents; this was treated of by Mr. Wood,[13] whose experiments showed that when unguents were introduced, there was a certain area of bearing surface, proportioned to the weight, which was peculiarly favourable as regarded the loss by friction, but that when this area was preserved, the friction was in strict ratio to the pressure.

It could not, however, have been Mr. Wood's intention, from these results, to impugn the applicability of the established general laws to the purposes of calculation, but only to show the existence of modifying circumstances under certain conditions; for the formula he had given[14] assumed the friction to be as the weight, and had no element in it expressing the area.

Mr. Rennie and M. Morin had also examined the influence of the unguents, and had found that their introduction did not materially alter the general laws of friction, but only affected the value of the co-efficient or multiplier to be used in ascertaining its numerical amount.

Having thus brought before the meeting the result of the principal experiments on friction, Mr. Pole concluded by adducing the testimony of writers on mechanics, who guided by these results, had promulgated the laws deduced from them. He gave quotations from the following authors in corroboration of his views, viz.—Emerson,[15] Playfair,[16] Tredgold,[17] Barlow,[18] Lardner,[19] Farey,[20] De Pambour,[21] Poisson,[22] Pratt,[23] Whewell,[24] and Moseley.[25] With the last mentioned author Mr. Pole had taken an opportunity of conversing upon the points in question, and the principles adopted in the paper had received the Professor's full approbation as corresponding with those made use of in his own treatises.

Mr. Vignoles thought that great praise was due to Mr. Pole, for the research and mathematical reading exhibited in treating the question of comparative friction. In the former remarks he had made, it was not his intention to impugn the accuracy of the abstract proposition, "that friction was independent of the area of bearing surface," any further than to qualify it in its practical application, with the proviso, "that proper proportions were maintained between the area and the pressure, according to the description of mechanism subjected to friction." He therefore desired to consider the question, as to how far in practice one kind of engine varied from the other in the general amount of friction, and to examine how far the areas of the bearing surfaces, were in proportion to the insistent weight, caused either by the strain of any angle or by the direct weight on any of the journals of the moving parts; this inquiry should precede the abstract mathematical investigation. The friction of different substances would not follow the mathematical rule, unless the due proportion between area and pressure was ascertained and observed; these proportions would be very different in heavy machinery, such as marine steam-engines, and the axles of railway carriages. With these qualifications he agreed with the general propositions laid down by Mr. Pole.

Mr. Murray agreed with Professor Vignoles in thinking that the extent of surface in machines materially affected in practice the amount of the friction. He did not mean to advocate the correctness of Professor Vince's experiments, but he would draw attention to the results quoted by Dr. Gregory,[26] in which the difference of Vince's experiments and those of other writers on the subject, was attributed to their not taking into account the cohesion of the bodies experimented upon. Their experiments were made with inclined planes, which were raised until the bodies began to move, and the amount of friction was then deduced from the angle of inclination that had been given to the plane: from this mode it was contended that no definite laws could be laid down. Mr. Murray acknowledged that on dry surfaces, within certain limits, the amount of friction was not influenced by the extent of surface; but he contended that in practice, as different kinds of unguents were used, the cohesion arising from the impurity and clamminess of these lubricating substances, must be considered and allowed for.

Major-General Pasley said that when he was quartered at Malta, he tried some experiments on friction, by having a slab of Maltese stone, which resembled the oolite of Bath, rubbed smooth and placed horizontally; other pieces of smooth-faced stone of the same quality, but of different areas, were then attached to a cord which was weighted and passed over a pulley; the weights which were just sufficient to give motion to the several pieces of stone, were then noted, and it was found that the area of the surface was not important, the friction being directly in proportion to the insistent weight of the stone. He could therefore corroborate Mr. Pole's propositions.

Mr. Farey considered that Mr. Pole had treated the subject of friction so well, and had selected his authorities in such a manner as to establish his position incontrovertibly; he would therefore only remark, that in collating the friction experiments for his work from Dr. Gregory and others, he had in a measure rejected those of Vince, as being on too small a scale, and not of sufficient importance to rely upon as authority. It must be admitted, that viewing the question practically, there were circumstances which would influence the proposition. If the surface of a journal was so small as to drive out the unguent, or to cut into the lower bearing, the friction would be unduly increased, and the theoretical position would no longer hold good. The use of unguents would not interfere with the general proposition, although in practice, any substance used for lubrication, which, when cold, solidified and became adhesive, might, for a time, produce an increase of friction; this of course would be avoided, but it would not bear upon the general question.

Mr. Rennie corroborated the position assumed by Mr. Pole, "that friction was independent of the extent of the rubbing surface;" his experiments, which had been tried on a large scale, and with various substances, gave uniformly this result, within the limits of abrasion; when that commenced, the bearings heated and there was an end of the theoretical position. The texture also, of the rubbing surfaces altered the condition; for instance, any light body covered with cloth opposed a considerable resistance by the friction of the raised nap; but if the body was weighted, it again came within the limits of the law, because it more nearly resembled hard substances, which alone were considered in theory. Hard and soft woods varied, of course, in the same manner. The friction upon each other of metals of different degree of hardness, caused in practice, some little variation, but it was so slight, that the rule quoted, might be safely received as correct.

Mr. Davison stated that he some time ago made several practical experiments with an Indicator, constructed by Messrs. Maudslays and Field, for the purpose of ascertaining the power required to drive various kinds of machinery, in Messrs. Truman, Hanbury, Buxton, and Co's Brewery.

1st. He found, that an engine which indicated 50 horses power when fully loaded, showed, after the load and the whole of the machinery were thrown off, 5 horses, or one-tenth of the whole power.

2nd. 190 feet of horizontal, and 180 feet of upright shafting, with 34 bearings, whose superficial area was 3300 square inches, together with 11 pair of spur and bevel wheels, varying from 2 feet to 9 feet in diameter, required a power equal to 7·65 horses.

3rd. A set of three-throw pumps, 6 inches in diameter, pumping 120 barrels per hour, to a height of 165 feet, = 4·7 horses.

By the usual mode of calculation, (viz., 33,000 lbs. lifted one foot high per minute,) it would appear that there was, in this case, friction to the extent of 13 per cent.

4th. A similar set of three-throw pumps, 6 inches in diameter, pumping 160 barrels per hour, to a height of 140 feet, = 6·2 horses.

By the same mode of calculation as before, there was here, friction to the amount of 15 per cent.

Mem. de l'Institut., 1833, 1834, and 1838.
The Mechanical Principles of Engineering and Architecture. By the Rev. H. Moseley, M.A. 8vo. Longman and Co. 1843.
Ibid pp. 138. 139.
[12] Phil. Trans., 1785, p. 165.
Treatise on Railroads, 3rd Edit. p. 396. et seq.
[14] Ibid., p. 355
[15] Mechanics, 1769. Prop. 62.
[16] Outlines of Nat Phil., 1834, Art. 159.
[17] Treatise on Railroads, 1825, p. 46.
[18] Math. Dict., Art Friction.
[19] Library of Useful Knowledge, Mechanics, 3rd Treatise, Art. 7.
[20] Treatise on the Steam Engine, 1827, p. 60,
[21] Treatise on Locomotive Engines 1840, chap. viii.
[22] Traité de Mécanique, 1833. Art. 456.
[23] Mechanical Philosophy, 1830, Art. 118.
[24] The Mechanics of Engineering, 1841, Art. 101.
[25] Mechanical Principles of Engineering, 1843, Art. 133, and Part 3rd, passim.

[26] Gregory's Mechanics, vol. ii, p. 25.

5th. A set of three-throw pumps, 5 inches in diameter, raising 80 barrels per hour, to a height of 54 feet, = 1 horse.

By calculation, as before, the friction amounted to 12¼ per cent.

6th. A set of three-throw "starting" pumps, pumping 250 barrels of beer per hour, to a height of 48 feet, = 4·87 horses.

By calculation as before, the friction amounted to 15¼ per cent.

7th. Two pair of iron rollers and an elevator, grinding and raising 40 quarters of malt per hour, = 8·5 horses.

8th. An ale-mashing machine, made by "Haigh," of Dublin; mashing at the time, 100 quarters of malt, = 5·68 horses.

9th. Two porter-mashing machines, made by "Moreland," mashing at the time, 250 quarters of malt, = 10·8 horses.

10th. 95 feet of horizontal "Archimedes screw," 15 inches diameter, and an elevator, conveying 40 quarters of malt per hour, to a height of 65 feet, = 3·13 horses.

Mr. Davison promised to continue these experiments, and to communicate the results to the Institution.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

March 7.—J. Shaw, Esq., in the Chair.

A paper "*On the contemplated Restoration of the beautiful Chapter House at Salisbury Cathedral,*" was read, by Mr. T. H. Wyatt, Architect to the Salisbury Diocesan Church Building Association, which is printed in full in the present number.

Mr. Ferrey read a paper "*On an old staircase at Tamworth Church which has fallen into decay.*" It is a sort of double corkscrew stair, winding in such a manner over each other, that two persons may go up and down without meeting, although both are circulating in the same well-hole. Mr. Ferrey offered some remarks as to its probable purpose. It is said to be a solitary instance of this exact kind of stair in England, but we remember to have seen one at Cologne.

April 3.—His Royal Highness Prince Albert, the Patron of the Institute, presided at a general meeting of the members, and presented the medals awarded during the session, for essays and drawings. His Royal Highness arrived punctually at the time appointed, attended by Colonel Bouverie; he was received by the Vice-Presidents, and the Honorary Secretaries, and conducted to the Library, where the other members of the Council being assembled, were severally presented. The Prince then presided at a Council, at which some ordinary routine business was transacted; and, subsequently, having inspected the various antiquities, casts and models in the collection, proceeded to the large room, where his Royal Highness took the chair, and the business of the day was commenced. The minutes having been read, and some donations announced, Mr. Donaldson, Foreign Secretary, read letters from Italian and French correspondents, at Milan, Coblentz, and Paris.

Mr. Fowler, Honorary Secretary, read Bacon's Description of a Princely Palace; and Mr. A. Johnson was presented to the Prince as the author of the best design founded on that description, and received the Soane medal. In like manner his Royal Highness presented to Mr. E. Chamberlain, of Leicester, the medal of the Institute, for his essay on the subject proposed, "*Are Synchronism and Uniformity of Style essential to beauty and propriety in Architecture;*" and to Mr. J. W. Papworth, the medal of merit, for an essay on the same subject.

Mr. Bailey announced the subjects for essays and drawings, for which the Council propose to offer the medals for the ensuing year, and then read a communication from Mr. C. Parker, "*On the modes usually adopted in forming Foundations in the city of Venice,*" the soil of which city is of a nature to require the greatest care, and yet where failure is seldom if ever seen.

At the conclusion of the proceedings Mr. Barry addressed the Prince in the name of the Institute, and expressed, in a few words, the grateful sense entertained by the members, of the honour conferred on the body by the gracious manner in which his Royal Highness had acceded to their wishes in presiding on the occasion: to which his Royal Highness very graciously replied, that he had felt much pleasure in taking part in the proceedings of the day.

THE NEW HOUSES OF PARLIAMENT.

The Commisioners on the fine arts, of which Prince Albert is the head, having called upon Mr. Barry, as architect, to furnish them with a report as to his views relating to the "internal decorations, additions to building, and local improvements," that gentleman transmitted his report to his Royal Highness and the Commission last month. Judging the subject as likely to interest our readers, especially as many of the suggestions offered by Mr. Barry will undoubtedly be carried out, we place the following particulars of the proposed decorations, &c. before our readers, for which we are indebted to the *Morning Herald.*

"As presiding over her Majesty's commissioners for encouraging the fine arts in connection with the rebuilding of the new Houses of Parliament, I venture to address your Royal Highness, and, in compliance with the instructions of the commission, to offer the following suggestions relative to the internal finishings and decorations of the new Houses of Parliament, the completion of the exterior and local improvements, which are, in my opinion, necessary to give full effect to the new building; and by way of illustration of the remarks I have to make on these subjects, I beg to transmit the accompanying plan of the principal floor of the new building, a general plan of part of Westminster, in which the new building is shown in connection with various improvements proposed to be made in its locality, and two drawings relating to Westminster-bridge.

THE DECORATIONS.

"With reference to the interior of the new Houses of Parliament generally, I would suggest that the walls of the several halls, galleries, and corridors of approach, as well as the various public apartments throughout the building, should be decorated with paintings having reference to events in the history of the country; and that those paintings should be placed in compartments formed by such a suitable arrangement of the architectural designs of the interior as will best promote their effective union with the arts of sculpture and architecture. With this view, I should consider it to be of the utmost importance that the paintings should be wholly free from gloss on the surface, that they may be perfectly seen and fully understood from all points of view. That all other portions of the plain surfaces of the walls should be covered with suitable architectonic decoration, or diapered enrichment in colour, occasionally enlivened with gold, and blended with armorial bearings, badges, cognisances, and other heraldic insignia, emblazoned in their proper colours. That such of the halls as are groined should have their vaults decorated in a similar manner, with the addition occasionally of subjects or works of art so interwoven with the diapered ground as not to disturb the harmony or the effect of the architectural composition. That such of the ceilings as are flat should be formed into compartments by moulded ribs, enriched with carved heraldic and Tudor decorations. That those ceilings should be relieved by positive colour and gilding, and occasionally by gold grounds with diaper enrichments, legends, and heraldic devices in colour. That the screens, pillars, corbels, niches, dressings of the windows, and other architectural decorations, should be painted to harmonise with the paintings and diapered decorations of the walls generally, and be occasionally relieved with positive colour and gilding. That the door-jambs and fire-places should be constructed of British marbles of suitable quality and colour, highly polished, and occasionally relieved by colour and gilding in their mouldings and sculptural enrichments.

"That the floors of the several halls, galleries, and corridors should be formed of encaustic tiles, bearing heraldic decorations and other enrichments in colours, laid in margins and compartments, in combination with polished British marbles; and that the same description of marbles should also be employed for the steps of the several staircases.

"That the walls, to the height of from eight to ten feet, should be lined with oak framing, containing shields with armorial bearings emblazoned in their proper colours, and an oak seat should in all cases be placed against such framing. That the windows of the several halls, galleries, and corridors should be glazed doubly, for the purpose of tempering the light and preventing the direct rays of the sun from interfering with the effect of the internal decorations generally. For this purpose the outer glazing is proposed to be of ground glass, in single plates, and the inner glazing of an ornamental design in metal, filled with stained glass, bearing arms and other heraldic insignia in their proper colours; but so arranged as that the ground, which I should recommend to be of a warm yellowish tint, covered with a running foliage or diaper, and occasionally relieved by legends in black letter, should predominate, in order that so much light only may be excluded as may be thought desirable to do away with either a garish or cold effect upon the paintings and decorations generally. Practically, I consider that the double glazing will be of essential service in carrying out the system of warming and ventilating proposed to be adopted in the building generally; which system renders it unnecessary that the windows in those portions of the building above referred to should be made to open, so that all prejudicial effects upon the paintings and other decorations, which might be caused by the dampness and impurity of the atmosphere, and much practical inconvenience, and probably unsightliness in the means that would be necessary to adopt for opening and shutting casements would be avoided.

"That, in order to promote the art of sculpture, and its effective union with painting and architecture, I would propose that in the halls, galleries, and corridors, statues might be employed for the purpose of dividing the paintings on the walls. By this arrangement a rich effect of perspective, and a due subordination of the several arts to each other would be obtained. The statues suggested should, in my opinion, be of marble, of the colour of polished alabaster, and be raised upon lofty and suitable pedestals, placed close to the wall, in niches, surmounted by enriched canopies; but the niches should be shallow, so that the statues may be as well seen laterally as in front.

"The architectural decorations of these niches might be painted of such colours as will give the best effect to the adjoining paintings, being relieved in parts by positive colour and gilding; and the backs of them might be painted in dark colours, such as chocolate, crimson, or blue, or they might be of gold, for the purpose of giving effect to the statues.

"Having thus described the views I entertain as to the character of the

decorations of the interior generally, I now proceed to notice in detail the special decorations and arrangements which I would propose for the several halls, galleries, and principal apartments.

WESTMINSTER HALL.

"I would propose that Westminster Hall, which is 239 feet long, 68 feet wide, and 90 feet high, should be made the depository, as in former times, for all trophies obtained in wars with foreign nations. These trophies might be so arranged above the paintings on the walls and in the roof as to have a very striking and interesting effect.

"I would further suggest that pedestals, 20 in number, answering to the position of the principal ribs of the roof, should be placed so as to form a central avenue, 30 feet wide, from the north entrance door to St. Stephen's porch, for statues of the most celebrated British statesmen, whose public services have been commemorated by monuments erected at the public expense, as well as for present and future statesmen whose services may be considered by Parliament to merit a similar tribute to their memories.

"The statues (26 in number) which have already been proposed to be placed against the walls, between the pictures, I would suggest should be those of naval and military commanders.

"The subjects of the paintings on the walls, 28 in number, 16 feet in length and 10 feet in height, might relate to the most splendid warlike achievements of English history, both by sea and by land, which, as well as the statues that are proposed to divide them, might be arranged chronologically.

"To give due effect to those suggested decorations, it is proposed that the light should be considerably increased by an enlargement of the dormer windows in the roof, by which also that extraordinary and beautiful piece of decorative carpentry of the 14th century may be seen to much greater advantage than has ever yet been the case.

"This noble hall, certainly the most splendid in its style in the world, thus decorated by the union of painting, sculpture, and architecture, and aided by the arts of decoration as suggested, it is presumed would present a most striking appearance, and be an object of great national interest.

ST. STEPHEN'S HALL.

"I would suggest that this hall, which will be 90 feet long, 30 feet wide and 50 feet high, and have a stone-groined ceiling, should be appropriated to the reception of paintings, commemorative of great domestic events in British history, and statues of celebrated statesmen in past, present, and future times. The paintings may be 10 in number, 15 feet long and 10 feet high, and 12 statues would be required as a frame to them. In the upper part of the hall, 30 niches will be provided for statues of eminent men of the naval, military, and civil services of the country.

THE CENTRAL HALL.

"This hall will be an octagon of 60 feet in diameter, and 50 feet high, covered with a groined ceiling in stone. As each side will be wholly occupied with windows, and arched openings of access, paintings cannot form any part of its decoration. It may, however, with good effect, be extensively decorated with sculpture. In the centre of the pavement might be placed a statue of her present Most Gracious Majesty, upon a rich pedestal of British marble, highly polished, and relieved in parts by gold and colour. The niches in the walls and screens might be filled with statues of her Majesty's ancestors, in chronological order, even up to the period of the Heptarchy. In front of the eight clustered pillars in the angles of the hall, might be placed, with good effect, sedent statues of some of the great lawgivers of antiquity.

THE VICTORIA GALLERY.

"This gallery will be 130 feet long, 45 feet wide, and 50 feet high, with a flat ceiling, and will admit of both paintings and sculpture. The subjects of the paintings on the walls, 16 in number, which may be 12 feet long and 10 feet high, might relate to some of the most remarkable royal pageants of British history or other appropriate subjects. Statues of her present Most Gracious Majesty might fill the central niches at the ends of the hall, and the other niches, as well as the pedestals between the paintings, might be occupied by statues of her Majesty's ancestors. These statues might, with good effect, be of bronze, either partially or wholly gilt.

CORRIDORS OF ACCESS THROUGHOUT THE BUILDING.

"The principal corridors of access to the various apartments of the building will be 12 feet wide, their ceilings will be flat, and they will be generally lighted from windows near the ceiling. The walls may be decorated with portraits as well as paintings, illustrative of some of the most remarkable events in the history of the country, or in the lives of its most eminent personages. For this purpose about 2,600 feet in length of wall, by a height of about seven feet, may be appropriated on the principal floor: 900 feet in length, by a height of about seven feet on the one-pair floor; and about 400 feet, by the same height, on the two pair floor. These paintings may be divided into subjects at pleasure, by margins or borders of architectonic decoration in accordance with the style of the building.

THE HOUSE OF LORDS.

"This house will be 93 feet long, 45 feet wide, and 50 feet high, will have a flat ceiling in panels. As the fittings for the accommodation required for the business of the house, together with the windows, which are necessary for duly lighting it, leave little space of plain wall, paintings cannot, with good effect, form any part of its decoration. Niches, however, will be provided, which might be filled with statues of royal personages. The architectural details of the ceiling may be enriched and relieved with gold and colour, and the windows filled with stained glass as before described. The whole of the fittings are proposed to be of oak, with appropriate carvings. The throne will be highly enriched and relieved by colour and gilding, and the back lined with cloth of gold, containing the royal arms emblazoned in colours.

THE HOUSE OF COMMONS.

"This house will be 83 feet long, 46 feet wide, and 50 feet high, and will have a flat ceiling. It is proposed to be finished in the same style as the House of Lords, but with less enrichment, and less of colour and gold in its decorations. The nature of its designs, and the extent of its fittings for the accommodations required, will not admit of either painting or sculpture.

THE QUEEN'S ROBING-ROOM.

"This room will be 38 feet long, 35 feet wide, and 20 feet high, and have a flat ceiling in panels, richly moulded and carved, and relieved with gold and colour. The ground of the panels of the ceiling is proposed to be of gold, covered with a diaper enrichment, and blended with legends, genealogical devices, badges, cognisances, and other heraldic insignia, and in colour.

"The wall-fittings of the room are proposed to be of oak, richly carved and moulded, and enriched with heraldic and other decorations in positive colour, relieved with gold. Compartments will be formed in the wall-framing, which might be filled with paintings referring to events in British history in which the Sovereign has personally taken a conspicuous part, or with other appropriate subjects.

THE ANTI-ROOM, OR GUARD-ROOM.

"This room which adjoins the Queen's robing-room, will be 38 feet by 33 feet, and 20 feet high. The ceiling will be of oak, with characteristic decorations. Oak framing, eight feet high, with heraldic decorations, and a seat at the foot of it, will line the room. The walls are proposed to be covered with representations of battle-scenes, and pageants of English history, in which an opportunity would be afforded of displaying the warlike costume of its several periods.

THE CONFERENCE HALL.

"This hall, which is in the centre of the front towards the river, will be 54 feet long, 28 feet wide, and 20 feet high, and will have a flat ceiling. The walls are proposed to be lined with oak framing to the height of about 6 feet, above which they might be covered with paintings representing celebrated state trials, and extraordinary sittings of Parliament, conferences, &c.

AS TO THE APARTMENTS APPROPRIATED TO THE PRIVATE AND PUBLIC USES OF EACH HOUSE.

"These rooms consist of libraries, refreshment rooms, robing rooms, state officers' rooms, and committee rooms.

"Nine rooms are appropriated to libraries, six of which are fifty feet long, and 28 feet wide; two are 33 feet long, and 28 feet wide; and one is 32 feet long, and 23 feet wide. The refreshment rooms are four in number, of which one is 60 feet long and 18 feet wide; two are 28 feet long and 18 feet wide; and one is 34 feet long and 18 feet wide. The robing rooms for the archbishops and bishops are three in number, of the respective sizes of 30 feet by 20 feet, 20 feet square and 16 feet square. The robing and other rooms for state officers are seventeen in number, averaging in size about 24 feet by 18 feet. The committee rooms are thirty-five in number. On the principal floor, five of them will be 37 feet long by 28 feet wide; two 35 feet by 26 feet; and one 32 feet by 23 feet. On the one-pair floor, two will be 42 feet long and 33 feet wide; one 54 feet by 28 feet; four 36 feet by 28 feet; ten 34 feet by 28 feet; and two 34 feet by 22 feet; and on the two-pair floor the number will be eight, averaging in size 28 feet by 20 feet. The whole of these rooms are about 20 feet in height, with the exception of those on the two-pair floor, which will be about 14 feet high, and will be lighted by windows of the usual height from the floor.

"The ceilings will be flat and formed into panels by moulded and carved ribs, relieved by characteristic and suitable carvings.

"The floors are to be of oak, with borders and inlays.

"The fire places and door jambs are proposed to be of British marbles, highly polished. The doors, frontispieces, linings of walls, and fittings, will also be of oak. In some of the rooms it is proposed that the wall framing should be carried to the height of six or eight feet, in others that it should be of the full height of the room, and with panels for paintings, portraits, &c.

"The plain surfaces of the walls might be covered with paintings of historical events, and the panels in the wainscoting might contain portraits of celebrated personages in British history.

"The architectural details, both in stone and plaster, might be painted in positive colours, occasionally relieved with gilding: and the armorial bearings, badges, and other heraldic insignia which will enrich the wood-framing, might also be relieved with gold and colour.

THE SPEAKER'S RESIDENCE.

"This residence, being designed for state purposes, might also be adorned with paintings. The style of its finishings, fittings and decorations will be in accordance with the best examples of the Tudor period.

"Its principal rooms for the purposes of state are as follows:—A reception-room, 34 feet by 23 feet; a library, 34 feet by 23 feet; a dining-room, 45 feet by 21 feet; a drawing-room, 38 feet by 22 feet; and a corridor of communication, 8 feet wide, surrounding an internal court.

"With respect to any further encouragement of the fine arts in the exterior of the building, I am not aware of any opportunities that offer, as arrangements have already been made for all the architectonic or conventional sculpture that will be required to adorn the several elevations. Equestrian statues of sovereigns in bronze might, however, be placed with considerable effect in the proposed quadrangle of New Palace-yard, the Speaker's quadrangle, and the royal court.

"I have now described, in general terms the whole of those portions of the building that might, I think, with propriety and effect be adorned with works of art, and the arts of decoration; but in making the several suggestions which have occurred to me, I should wish it to be understood that I have merely stated my own views on the subject, as far as I have hitherto been able to consider it in its general bearings, and with a view to show how the objects for which the commission has been established may, if desired, be carried out in the decorations of the new building to their greatest extent. I should not however, wish to be strictly confined in all cases to the adoption of even my own suggestions, as upon a more mature consideration of the subject in detail hereafter, when the shell of the building is completed, I may be induced to vary and modify some of the views which I entertain at present, and which, I fear, I have but imperfectly communicated in this paper.

AS TO THE COMPLETION OF THE EXTERIOR.

"It has ever been considered by me a great defect in my design for the new Houses of Parliament that it does not comprise a front of sufficient length towards the Abbey, particularly as the building will be better and more generally seen on that side than any other. This was impossible, owing to the broken outline of the site with which I had to deal. I propose, therefore, that an addition should be made to the building for the purpose of enclosing new Palace-yard, and thus of obtaining the desired front. This addition would be in accordance with the plan of the ancient palace of Westminster, in which the hall was formerly placed in a quadrangle, where, in consequence of its low level, it must have been seen and approached, as it would be, under such circumstances, to the best advantage. The proposed addition would, in my opinion, be of considerable importance as regards the increased accommodation and convenience that it would afford in addition to what is already provided for in the new building as hitherto proposed.

"It has long been a subject of serious complaint and reproach that the present law courts are most inconveniently restricted in their arrangements and accommodation. If it should be determined to retain the courts at Westminster, the proposed addition would admit of the means of removing this cause of complaint; it would also afford accommodation for places of refreshment for the public, for which no provision has been made in the new building, also for royal commissions and other occasional purposes required by Government, and now hired most inconveniently, in various parts of the town, at a considerable amount of rental; or for such of the Government offices as may, without inconvenience, be detached from the rest, such as, for instance, the office of woods, or for a record office, and chambers or residences for public officers. It will also afford the opportunity of making an imposing principal entrance to the entire edifice at the angle of Bridge-street and St. Margaret-street—a feature which is at present required, and which would add considerably, not only to the effect of the building, but also to its security in times of public commotion.

"Of the several local improvements suggested, none, in my opinion, is of greater or more pressing importance than that which I have to suggest in respect to Westminster-bridge. The anomaly of the size, outline, and character of that bridge, considered, as it ever must be from its proximity, as an adjunct to the new Houses of Parliament, must have forcibly struck every one who has passed over or under it since the new building has risen into importance; and the steep and dangerous declivities of the roadway, as well as its want of width for the traffic that passes over it, have constantly been a subject of public complaint.

"In order, therefore, to remove these serious objections, I propose that the superstructure of the bridge should be rebuilt upon the old foundations, which are now in course of being repaired and extended under the able superintendence of Messrs. Walker and Burgess. As it is, in my opinion, of the utmost importance, both as regards the effect of the new Houses of Parliament when viewed from the bridge, and the convenience of the public in passing over it, that the roadway should be made on the *lowest possible level*, I would recommend that the form of the arches of the new bridge should be pointed, by which great facility would be afforded for the accomplishing that very important object, namely, by materially reducing the thickness of the crown of the arches within what is considered necessary for arches of the circular form. I am induced also to recommend this form of arch on account of another very important practical advantage which it offers, namely, the elevation of its springing above the level of high water, by which the water-way through the bridge will be the same at all times of tide; whereas at present the spandrels of the arches offer an impediment to the water-way at high water nearly equal to 1-20th of its sectional area, occasioning rapid currents, with a considerable fall, and sometimes much danger to craft in passing through the bridge, under the influence of high winds. I consider it also of the greatest importance in an artistic point of view, not only that the bridge should be materially lowered, but that it should be made to accord with the new Houses of Parliament, in order that both in composition as well as style the *ensemble* should be harmonious and effective. Upon a rough estimate which I have formed of the cost of the new superstructure, I am satisfied it could be erected for about £120,000 beyond the cost it will be necessary to incur to carry out Messrs. Walker and Burgess's design for widening the present bridge to the extent proposed."

Mr. Barry, in continuation observes, it is clearly to be understood he has no desire to interfere with the employment of the engineers who are now engaged in the repair and extension of the foundations, whom he strongly recommends should be left to complete it. He expresses a hope that the commissioners, if they should think fit, will at their earliest convenience make a formal and urgent communication to the Government in accordance with the above views he has laid before them, as an early decision would be of great importance, in order that the works in hand may not be proceeded with farther than is necessary to carry out those views if they should be ultimately adopted.

The embankment on both sides of the river, from Vauxhall-bridge to London-bridge, he considers next in importance to the rebuilding of the superstructure of Westminster-bridge. He says:—

"As there would, doubtless, be serious objections to a public road upon the embankment on the north side of the river, I confine my observations to the southern side, where, if a road could be obtained, it would afford a succession of fine views of London, and the best situation for views of the principal front of the new houses of Parliament. Having maturely considered the subject, I think it would be practicable to obtain a public road of ample width upon arches, from the termini of the South-Eastern and Dover and the Brighton Railroads, at the foot of London-bridge to the terminus of the South-Western railway at Vauxhall.

"The road might be raised upon arches to a level that would coincide with the levels of the roadway of the several bridges which it would intersect, by which means the water-side frontages of the several wharfs need not be interfered with in any material degree; indeed, the extent of such frontages might, by the means of docks of convenient form and size, be very considerably increased, and the archways might, to a great extent, be appropriated, if desired, to warehouses and other purposes of trade. By extending the archways to a sufficient depth to the south of this road, a frontage for building might also be obtained, particularly opposite Privy Gardens and the new Houses of Parliament, where, if the houses were designed in masses, with reference to architectural effect, they would form an agreeable and striking view from the north side of the river, and effectually screen the present low and mean display of unpicturesque buildings on the Surrey side. The proposed houses, from being raised to a considerable elevation, would have a fine command of the river, and the principal public buildings of the metropolis, and having, in addition to these advantages, a southern aspect, would form very agreeable residences, such as would probably be eagerly sought for by the owners of adjoining wharfs, either for their own occupation, or that of their principal agents. Taking into consideration the private accommodation to the several wharfs, and the value of the new building frontage, the proposed work would probably yield a very considerable return for the capital expended upon it, and, when effected, would not only form one of the most striking improvements of an ornamental character of which the metropolis is susceptible, but would materially conduce to the convenience, the comfort, and the recreation of the public. It would also perhaps render unnecessary the line of road that has been projected from the termini of the railroads at the foot of London-bridge, through Southwark to the foot of Westminster-bridge, for the convenience of the west end of the town, as the distance to that part of London would be materially shortened by taking the proposed embankment road, and passing over Waterloo-bridge."

Of the local improvements immediately contiguous to the new Houses of Parliament and the approaches, Mr. Barry in continuation remarks:—

"Old Palace yard is proposed to be considerably increased in size by the demolition of the houses which now occupy that site, as well as the houses on both sides of Abingdon-street, by which means a fine area for the convenience of state processions, and the carriages of peers and others attending the House of Lords, as well as a spacious landing-place adjoining the river, would be obtained. The Victoria Tower, as well as the south and west fronts of the building, would thus be displayed to the best advantage. The Chapter house would be laid open to public view, and if restored, would form a striking feature in conjunction with the Abbey; and a considerable extent of new building frontage that would be obtained by this alteration might be occupied by houses of importance, in a style of architecture in harmony with the Abbey and the new Houses of Parliament, by which a grand and imposing effect as a whole would be produced. As one means of improving the approaches I propose that the noble width of street at Whitehall should be extended southwards by the removal of the houses between Parliament-street and King-street, by which the Abbey would be wholly exposed to view as far as Whitehall Chapel. The houses on the north side of King-street should be removed for the purpose of substituting houses or public buildings—if required, of an improving style of architecture.

"Millbank Street is proposed to be widened and improved in order to make it a convenient and effective approach from Millbank Road to the Victoria Tower and Old Palace Yard. Tothill Street is also proposed to be widened and improved in order that it may be made an equally convenient and striking approach to the Abbey, the Houses of Parliament and Whitehall from the west-end of the town. St. Margaret's Church, if suffered to remain in its present position should be improved in its external decoration, in order that it may not disgrace, as it now does, the noble pile of the Abbey, which rises above it."

Mr. Barry concludes the enumeration of all the principal improvements he judges to prove most effective to the building on which he is engaged, by the hope, although some might be considered impracticable, that at no distant period the rebuilding of the superstructure, the embankments of the river, the enclosure of New Palace Yard, and the enlargement of Old Palace Yard, may be accomplished as "improvements of the utmost importance, whether as regards the beauty of the metropolis, the effect of the new Houses of Parliament, or the convenience, as well as the enjoyment of the public."

THE IPSWICH COMPETITION AND IPSWICH CUSTOM-HOUSE.

SIR—Notwithstanding that so very much has been said on the subject of competition generally, and also in regard to particular cases of it, never has a more striking proof of the manner in which such matters are *managed*, been brought forward, than that furnished by the competition now in progress for a new Custom-House at Ipswich. This I think will be admitted by every one on reading the following statement and correspondence, for which I solicit insertion in your *Journal*, in order that the profession and the public may be acquainted with the whole affair, and clearly perceive how monstrously absurd are the so-called "Instructions to Architects," sometimes put forth on such occasions. No doubt this Ipswich affair is a very trumpery one in every meaning of the word—most remarkably so; and on that very account does it call for strong animadversion and exposure; since it is owing to so many things of the kind being quietly passed over, as too insignificant for notice, or because it is worth no one's while in particular to make any "fuss" about them, that they at length become an established system. Silence on the part of the profession looks like acquiescence, and local "committees," relieved from the wholesome fear of committing themselves, perfectly irresponsible to public opinion, and at liberty to act just as they please, no matter how capriciously, how arbitrarily, or how absurdly. Bodies of that kind have, like private individuals, most unquestionably the right of pleasing themselves—that is, if they can, and also that of serving their own particular views and their own particular friends; but then it should be done in a different manner: for when they invite to competition by *public advertisement*, they become pledged to perfect fair dealing and impartiality, and bound to act with something like discretion. At all events, it may be supposed that they themselves have a tolerably distinct notion of what it is they do want, and ought, accordingly to express it as distinctly as they can: otherwise, the vagueness of their "instructions," either betrays their own incapacity, their inability to explain themselves in the first instance, and therefore, it may be inferred, their incompetence to judge afterwards on the designs admitted to them, or it very naturally excites a suspicion that all is not quite so fair and straightforward as it professes to be, but that the "instructions" have been conveniently mystified, in order not to enlighten people too much on the subject. Obscurity, we are told, is one source of the sublime: and if so, the committees who preside over competitions must be some of the sublimest people in the world.

One motive for my thus bringing forward this Ipswich affair, is the hope that the attention of the Institute of British Architects will now be called to it. It certainly is what it ought to take up; but although I belong to that body myself, I must own that it has hitherto shown itself by far too supine in all such matters: it is sadly deficient in that heartiness and zeal which, only exerted, would correct many abuses, and would no less directly than essentially benefit both the art and the profession. It ought not to leave to individuals in the latter, the onerous and not particularly gracious task of trying to effect what it is beyond the power of individual zeal and energy, however well directed to accomplish. The Institute, it may be presumed, possesses a certain degree of authority with public opinion: if so, let it exert that authority to some purpose, and beneficially. Let it convince the public that it is something more than a mere name, and that its influence extends beyond the walls of its own council-room. Unfortunately, however, those who have most weight and influence there, are least of all interested in bringing forward or promoting measures having for their object the interests of architecture and of the profession generally. That such should be the case is, perhaps, natural enough: why should those who are not at all personally affected by them, give themselves any concern about grievances and abuses which they do not feel, heavily as they may press upon and depress those who have to contend with them? The tranquility with which they view—for hardly can they be ignorant of them, may look like philosophy—like Mahommedan assignment to unavoidable evils; yet though their indifference may be very justifiable, all very prudent and proper, it certainly says nothing for their zeal, their generosity, or their public spirit; nor does it at all tend to raise the character of the Institute as a body in public estimation. *Tout au contraire*, it exposes it to animadversions all the more severe, because well merited. Perhaps I am now expressing myself rather strongly, and may besides be thought to spin out these remarks too largely; for I began them merely by way of preface to what follows, and to what I will now let follow at once without any further comment. "————"

"INSTRUCTIONS TO ARCHITECTS DESIROUS OF SUBMITTING DESIGNS FOR THE PROPOSED NEW CUSTOM HOUSE, IPSWICH, SUFFOLK.

"*To Architects.*

"The Corporation of Ipswich, propose to erect a public building upon the common quay, in that town, as a Custom-house and Excise-office; to comprise also, suitable offices for the accountant and collector of the dock commissioners, and other public business of the town connected with the mercantile and shipping interests; accommodation will also be required for the lessees or occupiers of the common quay wharf, which is the principal landing place for goods in the town, and any spare rooms may be adapted for private offices or a bonding warehouse.

"COST.—The expenditure not to exceed £4000.

"PREMIUMS.—Twenty guineas will be given for the first selected plan, and ten guineas for the second. Such two plans to become the property of the corporation. The architect whose design is selected will most probably be employed to superintend the erection of the building, provided he can produce satisfactory testimonials as to his ability, &c.

"SITE.—The site for the proposed building is an open space, measuring about 240 feet by 130 feet, with a water frontage.

"MOTTO.—The different drawings, &c., are to be distinguished by a motto, and the name and address of each architect to be sealed up in an envelope bearing the same motto as his design, which letter will be returned, unopened, to the unsuccessful competitors.

"The plans, &c., to be delivered at the town clerk's office, Ipswich, on or before the 1st of May next. The selection of the premium designs will be duly advertised in the local papers, after which, the remaining designs will be returned to their respective authors, on their writing for the same, stating the motto affixed to their various drawings, &c.

"S. A. NOLCUTT, JUN.,
"Town Clerk.

"Ipswich, March 1843."

"11th April, 1843.

"SIR—I shall feel obliged by your favouring me with replies to the following queries relative to the competition for the new Custom-house, Ipswich.

"1st. Is it necessary for the competitor to see the ground previously to preparing his desings?

"2nd. What is the nature of the foundation? will it be requisite to use piling or concrete, or is the natural soil sufficiently solid to bear the ordinary foundations of a building of the size and nature required, without any extraordinary outlay for this part of the work?

"3rd. What accommodation will be required for the Custom-house and Excise-office, and what dimensions will be required for the rooms?

"4th. What is to be understood by 'suitable offices for the accountant and collector of the dock commissioners;' are there two or more rooms: and about what dimensions will they be required?

"5th. What accommodation will be required for the 'lessees or occupiers of the common quay wharf?'

"6th. What spare rooms are expected to be provided for offices and bonding warehouse, and what dimensions are they required to be?

"7th. Are all the rooms, warehouses, &c., contained in the first paragraph of the 'Instructions to architects,' to be included in the expenditure of £4000?

"8th. What distance is the wharf or water from the site of the proposed building

"9th. For the premiums, is it expected that the architects should furnish the *requisite number of drawings* in order that the corporation may form a just decision on the comparative merits of the various designs? Will it be necessary that they furnish the following? viz.

"Elevations of the four fronts; plans of the different stories, foundations and roofs; six or seven drawings; one longitudinal and two or three transverse sections; one or two perspective views, about 16 drawings; a specification of the work and a detailed estimate of the cost.

"10. What scale are the designs to be drawn to?

"11. Are the elevations to be coloured, tinted in the sepia or only to be drawn in outline?

"12. Are the perspective views to be taken from any fixed points? And are they to be coloured or tinted in sepia?

"13. What materials are to be used in the construction of the outside walls, and in whatever decoration the limited funds will allow?

"14. As the architect whose design is approved will '*most probably*' be employed to erect the building, may I ask if any designs have been laid before the corporation previously to the competition being proposed?

"15. Have the corporation an architect, or any one possessing a knowledge of architecture in their employ?

"16. Will any means be adopted to ascertain that the designs can be executed for the sums estimated?

"17. Will the corporation undertake to lay aside all designs which cannot be executed for the sums estimated?

"18. By whom are the designs to be examined and selected?

"19. Are the parties who examine and select the designs well acquainted with the principles of composition in architecture, as regards unity of style, fitness for the end in view, and harmony to which I may add the principles of construction, and the proper application of materials?

"20. Is the approved design to be in strict conformity to ancient precedent, or to be an original composition, possessing all the requisites of a work of fine art?

"21. In case the corporation should consider it necessary to call in the aid of a professional architect to assist them in the selection of the designs, will his report be delivered in writing, and will it be published or otherwise be made known to the competitors, in order that they may have an opportunity of reflecting any opinion therein contained?

"22. The time for sending the designs is exceedingly limited. It would be of considerable benefit to the corporation as well as the architects that a greater length of time was allowed for preparing the design; can the corporation grant such a request?

"23. Is it intended that the designs should be publicly exhibited previously to the decision of the corporation?

"24. Who are the members of the corporation that are to form the judges in the competition?

"I have to apologize for taking up so much of your time; but without the information herein required it will be impossible to furnish suitable designs for the proposed building.

"Your earliest reply will oblige,

"Yours, &c.,

"Ipswich, 13th April, 1843.

"SIR—I have your letter of yesterday. It is quite impossible for me to give the answers you require. £4000 is the total sum to be expended. The dock commissioners would only require two rooms, and these not large. The architect may choose the site of the building in the area, the dimensions of which are furnished in the paper already sent to you, except that a roadway of 30 feet from the water's edge must be left free of any building. There is no limit as to scale. The time for sending in drawings cannot be extended.

"I am, Sir,
"Your obedient humble servant,
"S. A. NOLCUTT, JUN."

"14th April, 1843.

"SIR—I am exceedingly sorry to be so troublesome to you, but without the requisite data, it is impossible for any architect to prepare suitable designs for the Custom-house at Ipswich. If it is impossible for you to give me the information required, you may probably inform me to whom I am to apply. In the printed instructions to architects, there is so little information, that the whole accommodation required for the Custom-house is quite undefined; and whether the offices are for one or two clerks or more persons is not mentioned. I respectfully submit that the architect's answers to the queries I sent on the 11th instant should be given by the committee, who of course are fully aware of the accommodation they require. I shall feel obliged by an early reply.

"I am, &c.,

"Ipswich, 15th April, 1843.

"SIR—I have to acknowledge the receipt of your letter of the 14th, and regret that I can afford little more information than has been already furnished to you in common with those gentlemen who have stated their determination to send in plans for the new Custom-house here.

"I can only say, generally, that the business of the port in both departments, custom and excise, is not likely to be very considerable, and the dock commissioners would not require more than a couple of moderate sized rooms. The limited expenditure must of course govern the extent of the accommodation.

"I am, Sir,
"Your obedient humble servant,
"S. A. NOLCUTT, JUN."

"17th April.

"SIR—I should be wrong in expressing an opinion that the corporation of Ipswich were the only body who have published such vague instructions, when they require architects to prepare certain designs for the buildings they have it in contemplation to erect; was this the first instance of the kind, little could be said upon the subject, but as it is now the usual proceeding in most occasions of this nature, the profession, as a body, ought to complain; yet as a body, they do little, it therefore rests with individuals to do something.

"I would not for a moment suppose that the corporation have already decided who is to be the architect of the building, nor do I suppose that each member of that body has his particular friend to support, and therefore all the information he possesses is necessarily reserved for this friend, I say I cannot presume that this is the case, but the very great difficulty I have experienced in obtaining the *necessary* information so as to prepare the required designs, naturally creates a suspicion, especially as the numerous results of such proceedings confirm those suspicions. I presumed, when I wrote to you, that officially you had the power of answering all necessary questions, and that if you had not such power, at least you could direct me to some person who must have known what was required, better than a stranger, for the commercial business of the port. The dock commissioners, the accountant, the merchants, who are interested in the shipping, the occupiers of the common quay wharfs, the town clerk, and others interested or connected with the custom house, must individually have some idea of the accommodation; surely it would have been no great or difficult task to collect such information, in order that the corporation should get the *most suitable* design for their building—or if they do not know what they want, they can want nothing—this is a natural inference, and perhaps the least requiring an apology.

"I have to thank you for your letters, although you were unable to give me the information I required. It is my intention to publish in some periodical, the 'Instructions to Architects,' my queries, and the correspondence I have had with you on this occasion, my only wish being to obtain, in business of this nature, all the information that the subject may require, and in which I have been so unsuccessful in this instance.

"The most extraordinary thing in this competition appears to me to be that the corporation are to select the most suitable design for their building, yet admit through their official organ, that they do not known what is required, at least I must come to this conclusion, as the information I required on the most important subjects could not be obtained.

"I am, &c.,

SOUTH-EASTERN RAILWAY—(FOLKESTONE.)—The works at this place are rapidly progressing under the contractors for the works, Messrs. Grissell and Peto, who it is expected will be able to place the line soon in the hands of Mr. Betts, the contractor for the permanent way, and there is now no doubt that the line will be in operation within seven miles of Dover before the end of July next, neither now is there any doubt expressed as to which will be the direct line to France.

REVIEWS.

MR. PUGIN'S NEW WORK.

An Apology for the Revival of Christian Architecture in England. By A. Welby Pugin, Architect, Professor of Ecclesiastical Antiquities at St. Marie's College, Oscott. Small 4to., Ten Plates. London, 1843. Weale.

To recommend this production to the notice of our readers, would be almost superfluous, since it is one which can hardly by any possibility *escape* notice, or fail to obtain greater attention than usually falls to the lot of architectural publications in general, or even of such as have more than ordinary merit to recommend them. Any thing proceeding from the author of the "Contrasts" and "True Principles," is certain of being taken up with curiosity, and with not the least degree of it by those in whom that feeling may be more or less mixed with apprehension, and who are therefore anxious to discover whether they themselves come in for any remarks from a pen that is not always exercised very gently. In one respect, Mr. Pugin is quite alone, not only from all other architectural writers, but from nearly all other writers whatever; he is no respecter of persons, but speaks as one having authority—openly, boldly, without any observance of the *suaviter in modo*, without attempting to conciliate any one, and without caring what individuals he may offend. Mawkish liberality and excessive "good nature" are not among Mr. Pugin's foibles; so far is he from excusing himself upon grounds of "delicacy," and saying as little as possible in regard to living architects and their productions, that in speaking both of the one and the other, he goes to an extent quite unprecedented, except it be either in anonymous criticism, or hostile literary controversy. Neither is there any thing apologetic in his tone; he does not offer his opinions as merely those of an individual, but as positive and unquestionable dogmas, no less implicitly to be adopted than they are fearlessly proclaimed without the slightest misgiving on his part.

Whether it be altogether prudent or becoming in an individual, let his ability be what it may, to set himself up as a sort of oracle, and to assume a self-elected dictatorship over all the rest of the profession, is a point we leave others to settle. Be it either with or without "right," such is in a manner the case; nor have we to read far in his book before we find, that however unwarrantably it may have been usurped, Mr. Pugin is determined to exercise his office with a high hand. We do not know if this new volume of his is the same in substance with a series of architectural papers announced some time ago under his name, in the *Art Union*, but which never appeared. It is not altogether unlikely, for there certainly is much which not every editor would care to sanction; nor is Mr. Pugin a writer very submissive to editorial control, or disposed to expunge or qualify or soften down what may be objected to as offensive and unsafe opinions and expressions.

Like another Sir Huon, Mr. Pugin plucks a Sultan by his beard, the Sultan in this case being no other than the Professor—aye, the "living" Professor—of Architecture at the Royal Academy, whom he treats not at all more ceremoniously than he did Sir John Soane, when he showed up the "Professor's Own House." "It is a perfect disgrace to the Royal Academy," he says in a lengthy and piquant note, at his third page, "that its Professor of Architecture should be permitted to poison the minds of the students of that establishment by propagating his erroneous opinions of Christian architecture. The influence which his position naturally gives him over their minds is doubtless considerable, and the effect of his instructions proportionably pernicious. Not content, however, with the disparagement of ancient excellence, which he introduces in his official lectures, he is *practically carrying out* his contempt of pointed design in both Universities, and in a manner that must cause anguish of soul to any man of Catholic mind and feeling. The ancient buildings of King's College, models of perfection in their way, are actually being demolished in order to make room for a monstrous erection of mongrel Italian, a heavy, vulgar, unsightly mass, which already obscures, from some points, the lateral elevation of King's Chapel, and which it is impossible to view without a depression of spirits and feelings of disgust. A man who *paganizes* in the Universities deserves no quarter."!

We need not quote further, but may leave the remainder as a tit-bit in store for those who feel their curiosity wetted, by the "taste" we have given them of this formidable note, merely remarking here that it hints at "gin-palace design" at Oxford, and prophesies that those, and many other works of the present day, "will be the laughing stock of posterity." Still, though we are inclined to admit that the buildings Mr. Pugin so mercilessly reprobates are decidedly bad, yet not perhaps quite so much so as to occasion "anguish of soul," and actual "depression of spirits;" we consider them such, not because they are not of "pointed design," but because they are very tasteless and excessively poor in themselves—strangely crude and patched-up abortions, without any manifestation of study bestowed upon them, and egregiously defective, not only in regard to taste, but as buildings, and devoid of all unity of plan and composition. In falling foul of the professor for "paganizing" in the universities, Mr. Pugin is perhaps rather too severe, and somewhat unguarded, for there has been a good deal of "paganizing" elsewhere before now, and the example was set by the very fountain head of orthodoxy, the apostolic city, and by the very successors of St. Peter. The Vatican itself is most dreadfully and scandalously pagan; its galleries are a perfect rendezvous of heathenism. We are, therefore, at liberty to fancy that, although he has not had the candour to admit as much, Mr. Pugin devoutly damns "Leo's golden days," and the "paganism" of Popes and Cardinals, who, to make use of his own expressions, poisoned the minds of architects, artists, and students of all countries, by propagating erroneous opinions of Christian architecture and art. Certain it is that he could not point to that quarter, to Catholic Rome itself, as a model of Christian and Catholic purity, or else he would most assuredly have done so in the language of triumphant argument: whereas it may fairly be suspected, he is tolerably conscious that the less said on that head, and the more it is kept out of sight, the better, since he would, no doubt, be puzzled to reconcile the gross laxity of Rome, with his own rigorous ultra-Catholicism in architecture. Why, then, does he keep continually harping upon that string? why is he for ever taunting the profession and the public with a reproach which, however well deserved, and how great soever he may consider it to be, cannot possibly have any effect upon either? He tells them that architecture is no longer "the expression of our faith, or government, or country;" and they reply by laughing at him in his face, as a crack-brained enthusiast—an arrant Don Quixote, the champion *à l'outrance* of a chimerical Dulcinea. He lays by far too much stress on what are now regarded matters of perfect indifference, and not without reason so—on the mere externals and paraphernalia of religion, which both have been and are substituted for religion itself where not a particle of the latter exists. The attaching so much importance to the *costume* of devotion is dangerous, for it leads to a species of mummery and mountebankery which disgraces what it professes to honour.

It might be more discreet on the part of Mr. Pugin were he not to dwell so emphatically and so exclusively, on what forms the staple of his writings, and renders them quite as much polemical as architectural. Most certainly we should have been better satisfied had he obtruded upon us fewer of his religious opinions, and favoured us with something more in the shape of tangible criticism. Of the last we obtain but very little; it may, perhaps, be said to be in the "*pointed*" style—and so far appropriate enough: yet it is too bare and indiscriminate, and is in manner what would be termed downright verbiage and flippancy in a reviewer, or a magazine article. By denying all merit to, and endeavouring to convict of absurdity whatever does not belong to the only style of the art he is disposed to tolerate, he overshoots the mark altogether, and deprives his strictures of efficacy. He gives—at least leaves, us to understand, that our former English style is the only one at all suitable for us, and that all buildings in any other, are, without further inquiry into their merits, to be condemned as naught. The consequence is, the sweep-

ing invective becomes a most harmless, if not inoffensive tirade: falling all alike, it affects no one in particular more than another, but leaves all, the best and ablest as well the most imbecile and the meanest, involved in the universal disgrace. So that the latter may even take consolation to themselves, by finding that their superiors are brought down to their own level, and made to appear just as incompetent as themselves.

With respect to Mr. Pugin's remarks on what has been done in architecture within the last twenty years, we do not complain so much of their severity and of want of patriotism, as of the indiscriminate censure manifested in them. It would seem, that all is bad alike—that is nothing for exception—that the Italian style is quite out of place in the Travellers' and Reform clubhouses, and treated without either propriety or *gusto*. We cannot, indeed, for a moment suppose that such is really Mr. Pugin's opinion—for in that case his opinion would be perfectly valueless, but what he says implies nearly as much, though he has reserved to himself the power of explaining a good deal of it away by saying that it is to be understood in a qualified and limited sense. At all events, what he does say, amounts to little more than the expression of uniform disapprobation: let him make what exceptions he may, he reserves those for the ear of his father confessor, who is not likely to divulge them. While, however, we agree with him that, notwithstanding the enormous sums they have cost, many of our public buildings are decided architectural failures, we are of opinion that the mischief is not so much to be attributed to the style adopted for them, as to the incompetence and want of artist-like feeling with which it has been treated. We are far also from believing that the style, so exclusively advocated by Mr. Pugin, would have been at all more appropriate or more efficacious, in the majority of the instances alluded to. The merely adopting a style does not confer genius; so far from it, that were we to judge of any particular one by the use which is made of it, we should be compelled to confess that the "pointed" is the most barbarous a balaam style conceivable, according to a great many modern samples of it.

Not content with advocating the claims of the pointed style for ecclesiastical and collegiate structures, Mr. Pugin seeks now to recommend it, exclusively of every other, for modern buildings of all kinds—for street architecture, dwelling houses and shops, although the specimens he gives are not at all calculated to enforce his arguments. Had any one else ventured to propose "Gothic" for shop fronts and windows, he might have been fancied to be quizzing. Nearly arrant masquerade in itself, such a system would tend to deteriorate the style most deplorably. Unless none but *artists* were employed, it would in a short time become a mere parody of the original—maimed, barbarous, and not to be beheld without "anguish of soul," by those who have any feeling for the original itself. No: the present negative style of our street architecture is infinitely preferable, inasmuch as no smell at all is better than a stink. Dull and monotonous as they are, the walls and holes in them for windows which form our streets, are preferable to what the author of the "Apology" recommends; there is no more to admire in them—no more design or variety than in the pavement itself, but there is also nothing to offend, nothing that solicits notice merely to disappoint and disgust.

There are, indeed, particular occasions where the pointed style might be applied, not only with propriety and consistency, but with admirable effect, although they have not been referred to by Mr. Pugin;—we mean, covered markets, and covered avenues of shops. For the former, an open timber roof would be perfectly in character, while a cloister gives us almost a direct model for a Gothic "arcade," requiring no further modification than as regards matters of detail. In such cases, while the design could be kept up consistently, without the slightest interference from individual fancies and caprices, there would be nothing to detract from or neutralize the effect of the ensemble—nothing to clash with it—nothing "over the way," altogether different in physiognomy to jar and jumble with it, in preposterous discord. For houses in the country, the Gothic style is sufficiently accommodating: they are generally built for the actual occupiers—at least for the family to whom they belong, and allow of greater study being bestowed upon them, and the style being properly kept up; but widely different is the case with houses built by wholesale as mere trading speculations. Supposing that indispensable detail, string-courses, copings, weather mouldings, &c., added nothing to the expense, and that carved decoration could be had for very little, yet family devices, heraldic ornaments, mottos and legends must be omitted, unless they could be changed with every change of tenant, since otherwise their incongruity—supposing such things to have any meaning at all, might occasionally prove more ludicrous than agreeable. We might further object that the lofty roof and gable shown in one of the specimens for domestic or street architecture at the present day, would be far from being any improvement upon the system of building now in vogue. Undoubtedly such things tend to give character externally, but then it is after a manner almost at direct variance with the normal principle laid down by Mr. Pugin himself—that every building should be natural, without disguise or concealment, and that nothing should be introduced that does not recommend itself by obvious propriety. It cannot, indeed, be said that in this case there is any disguise, yet there is surely the other error of loading a house with a steep roof—the rooms within which can evidently be but mere garrets—merely because it produces a better effect. Experience has taught that such pitch is quite unnecessary—at least for mere dwelling houses; therefore, to re-adopt it again, would be somewhat preposterous, since it is certainly attended with increased expense—and perhaps with no inconsiderable increase of danger too in case of fire, unless it be intended that iron should be substituted for timber, because otherwise the flames would quickly extend themselves along a whole range of lofty timber-framed roofs.

If such roofs therefore be, as Mr. Pugin will probably contend, so essential to the true character of the style, that it cannot be properly kept up without such feature, it then becomes a very natural question: "Why seek to bring into general use again a style which is so ill-accommodated to our actual wants and purposes, that it will not admit of being modified according to them?" We hardly know if we are to assume as a matter of course that it is intended the interior character should be in perfect keeping with the external elevations, and not only in regard to the architecture and fabric itself, but fittings-up and furniture. That is a point which Mr. Pugin passes over altogether, without giving us any kind of remark, instruction, or caution relative to it; and yet it is one which calls for the n all, it being one in no small degree embarassing. It is true the Gordian knot may be easily cut through, by saying: so that the fronts be of antique and quaint physiognomy, no matter what the inside of the houses be;—they may be in any style, or no style at all. We cannot, however, even for a moment suppose that Mr. Pugin himself would consent to get over difficulties and objections in that way, since that would be converting his elevations into mere "*pointed masks*," and sham architecture. No one knows better than the author of the "Apology," that in order to have all in due keeping, furniture and fittings-up require quite as much study as the architecture itself—perhaps more, at least more research first, and contrivance afterwards, there being few models for our express guidance. No one is more alive to the absurdities and "monstrosities," foisted upon their customers, by cabinet-makers and upholsterers, under the name of "Gothic furniture," for he has indulged in a good deal of bitter pleasantry on the subject, in his "True Principles." Nevertheless, he now recommends what would inevitably lead to greater extravagances and absurdities of the kind; for if they have not been avoided where expense has been no consideration, where superior workmen have been employed, and where more than ordinary attention—albeit not directed by intelligence—has been bestowed, it is but reasonable to suppose that abominations still more flagrant would be perpetrated, were it attempted to render such style of furniture universal.

Important, however, as this portion of his subject is in itself, Mr. Pugin treats it so very summarily that all he says on it does not exceed our own comments, in length. We regret this, because we hoped to find and were curious to learn, how the pointed or old English

style, could be peculiarly applicable to "civil architecture" generally, as the heading of the section led us to expect. It is a view of the matter, which while it has hardly been touched upon at all, affords a very wide field for remarks and critical inquiry; we are willing therefore to hope that Mr. Pugin will now pursue it much further, and give us an entire volume or separate essay upon that particular subject. We would further hint to him that his criticism partakes too much of mere assertion and opinion; and he, is withal, apt to bestow too much notice on downright paltrinesses which no one pretends to defend, or on minor defects. He complains for instance, that the kitchen court of Lambeth Palace, into which, it seems, he accidentally found his way, is not at all in keeping with the external elevations, the architect having there laid aside "his gothic *domino*;" whereas, in our opinion, it would have been far more to the purpose to examine the "gothic *domino*" itself, which most egregiously disappointed us when we first beheld it, for it is exceedingly *pale*,—passably enough correct, but deplorably spiritless and insipid.

We would further advise Mr. Pugin in future to give us less ding-dong about Catholicism and Protestantism. It looks as if the professed subject was made a mere "stalking horse" to something else: for aught we know, it may be all very good policy for himself, but hardly for his book. If he really expects to gain converts to his own creed, by any thing he can say in its favour, he must have as good a conceit of himself as the Quaker who undertook a journey to Rome, in the hope of converting the Pope. In his zeal for Catholicism, Mr. Pugin may be very sincere, but the world will not give him credit for being perfectly disinterested; therefore, it might be more discreet in him not to challenge in the manner he does, inquiry into his motives. There is besides no occasion for his going out of his direct and proper course, because that affords ample matter—more than he has on this occasion given consideration to. We shall always be happy to meet Mr. Pugin as an architectural writer; as a polemical one we can spare him, nor will all his pomp of words gain him one convert among Protestants, to "the the trumperies and mummeries" which he identifies with christian architecture, and with christianity itself.

Instruction in Drawing for the use of Elementary Schools. By Butler Williams, C.E., F.G.S., &c.

A Manual for Teaching Model Drawing from Solid Forms, combined with a Popular view of Perspective. By Butler Williams, C.E., F.G.S., &c. London: John W. Parker.

We have not space to enter into any lengthened notice of these works in the present journal, we can only now state, from a hasty glance at both volumes, that they appear to have been compiled with considerable care, and that much attention has been bestowed to render the teaching of drawing less irksome than is usually practised.

English Patents for 1842. By Andrew Pritchard, M.R.I., London: Whittaker and Co.

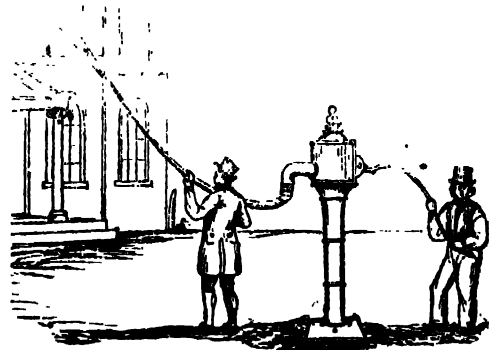
This useful work contains an alphabetical list of all the Patents, amounting to 7089, granted in England during the last year; there is also a classified index, and a concise account of the Law of Patents in Belgium.

Ancient Irish Pavement Tiles. By Thomas Oldham, A.B., F.G.S.S, L. & D., Dublin: John Robertson.

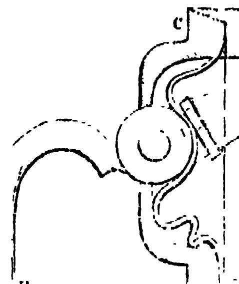
We have already noticed a work on Encaustic Tiles taken from examples in England, to this work the one before us forms an excellent companion, it contains no less than 32 patterns of tiles after the originals in Ireland, existing in St. Patrick's Cathedral, and Howth, Mellifont, and Newton Abbeys. Mr. Oldham, in his introductory remarks, informs us that there are three distinct kinds of Irish specimens—1st, Impressed; 2nd, Encaustic; and 3d, Tiles in Relief.

Turnpike Road through the Potteries.—This contract is let to Messrs. Bowers and Mundy, at about £2,500. The competition was so close that other parties were within fifteen pounds

ROE'S IMPROVED PUMP.



The improvement consists in that part of the pump called the stuffing box, rendering such a box of no utility, and introducing in its stead a joint composed of leather, or any other flexible substance, such as indian rubber, cloth, webbing, &c. The material employed is cupped sufficiently large to allow the lever of the pump working the piston without any tension whatever taking place.



The joint, it will be perceived from the diagram, is fixed upon the side of the pump barrel, so that when a head is placed on the pump, the head forms an air vessel, and it becomes a powerful fire engine without any extra expense. A, the leather cup shown on section; B, the handle passing though it; C, C, the part by which the joint is secured to the pump barrel. For deep wells this is an invaluable invention, as it is impossible that any leakage can take place; and all acquainted with the common lift pump will at once see the importance of the improvement. By it, also, much labour is overcome, as in the old method in a very short time the rod works a large space in the packing, and much of the water flows back into the well, which, by the new method, is safely brought to the surface. A further important improvement is, that friction is by this means removed. Instead of the piston rod being screwed up tightly in the tow, &c., the rod works quite easily in the joint. One of these fire pumps we are informed has been fixed at St. James's Palace and another at the House of Commons.

DREDGING MACHINE.

Sir.—Perhaps you will allow me to make the following observations in your *Journal* with reference to a letter upon Dredging in your last number, by a person signing himself W. C. And which I think you will more readily do, as it appears to me you have yourself inadvertently misunderstood the improvement intended to be described by W. C.—

You state in your editorial remarks, that "in this *new process*, a lateral "sweep or circular motion is given to the ladder or bucket frame which "swings upon its *upper extremity as a centre*, and in its action imitates "that of a scythe in mowing, &c.;" whereas, *I* do not understand from W. C's. description that the bucket frame has any *such motion* with regard to the dredging machine, but that the whole engine moves radially; the length of the head rope (perhaps one or two hundred yards) being radius, and its anchor the centre of motion.—If I correctly understand W. C's. description, I have to observe that *this* is no new process at all, that this method was adopted at least 23 years ago by Mr. Cubitt (one of the vice presidents of the Institution of C. E.) in dredging a cut of considerable extent in the Ipswich river,[1] and since that time in a new and more complete dredging engine for the Norwich Navigation. The latter machine having been for some time past under my management, I can vouch for the excellence of its working, and I flatter myself that if W. C. had ever seen such an engine he would not have said that the civil engineer has made "no advancement in the working of the machine," a well arranged dredging machine being

[1] Whether this method was first introduced by this gentleman or not I do not know.

already to the civil engineer, what the planing machine is to the engine maker.

I will mention as an instance of the accuracy with which dredging *can* be performed by engines like that I have alluded to, that I have been in the habit periodically of removing a large accumulation of mud with it from the rails of one of Morton's patent slips, touching each rail throughout and leaving the whole clean, and without the slightest injury from one end to the other.

I am, Sir,
Your obedient servant,
GEORGE EDWARDS.

York Chambers, Adelphi,
April 15, 1843.

[We are obliged to Mr. Edwards for his correction; upon inquiry we find that the radius cutting described by W. C. in the last month's *Journal*, is the same as that given by Mr. Edwards in the above communication.—Editor.]

THE SELF-REGULATING EXPANSION SLIDE VALVE.

SIR—In a late number of your *Journal*, I perceive that there is a communication from Mr. H. H. Edwards, of a plan for working steam engines expansively, by means of a plate at the back of the slide valve, which is regulated in the extent of its motion, by means of arms worked by the governor. It is stated that when the plate is held fast by the arms, the steam will be cut off to the greatest extent. Now a very slight examination of the drawings will show that though the steam is cut off as soon as the port of the cylinder is half open, admitting steam during rather less than one-fourth of the stroke, yet on the return of the valve, the port will again be opened, and will allow the steam to pass into the cylinder during the last quarter of the stroke. The same will take place, in a less degree, in every position of the arms until they are at a distance equal to the width of the small ports from both ends of the plate, which is the only place in which they can be of any service, so that of course the plan of altering them by the governor fails.

I am, Sir,
Your obedient servant,
THROTTLE VALVE.

Glasgow, 18*th April*, 1843.

FLAX MILL AT CASSANO, LOMBARDY.

SIR—I observe in your excellent number for April, a slight mistake, in an article headed—"Flax Mill at Cassano, Lombardy." Mr. Albano, C. E., of London, is therein stated to be the erector of the works, which may be correct, inasmuch as he was the superintendent of the building of the mill. The mechanical work, that is, the water-wheel and mill-gearing, were solely constructed and erected by Mr. Fairbairn, of Manchester; the greatest credit is therefore due to that eminent engineer in regard to the execution of the mechanical part. *Fiat justitia ruat cœlum.*

I am, Sir,
Your obedient servant,
S. N. S.

London, Tuesday, April 4, 1842.

RESPONSIBILITY OF CONTRACTORS.

In the Court of Exchequer, Saturday, April 22, 1843.—*Sittings in Banco at Westminster.*

TOWNLEY, CLERK, V. COLEMAN.

The Attorney-General moved in this case for leave to enter the verdict for the defendant upon facts found by the award of the arbitrators to whom the cause had been referred, or to set aside that award, and for a new trial.

This was an action in which the plaintiff, who is a magistrate for the county of Norfolk, sought to recover damages on behalf of the county from the defendant, who is a builder, under the following circumstances:—The magistrates having determined to erect a bridge near Downham, procured certain plans from an eminent architect usually employed on such occasions, and then advertised for tenders. The defendant became the successful competitor for the job, and, according to the usual course, entered into a contract, to which were attached the plan and specifications. One of the covenants in this contract was, that the bridge should be finished within a specified time, and "kept in repair by the defendant for one year afterwards." When the bridge was completed, the architect and engineer certified that the work had been executed to their satisfaction, and the claim of the defendant was forthwith liquidated by the county treasurer. Little or no repairs were required at the hands of the builder during the early portion of the year, but towards its close the bridge gave symptoms of instability, and just before the expiration of the time, it fell in altogether. When called on to comply with his covenant, the defendant refused, on the ground that the failure of the bridge was not owing to the insufficiency of the work executed by him, but to the inherent vice of the original plan, which, as he averred, was of a nature altogether insufficient and vicious. Not satisfied with this, the present action was instituted, and having been referred to a learned gentleman and two architects, the present award was afterwards made, in which certain facts were found, which fully bore out the above answer of the defendant to the action, and damages were assessed contingently upon the opinion of this Court as to the sufficiency of that answer in point of law. The learned gentleman now at great length urged upon the Court the hardship of attaching the penalty for the architect's defective plan upon the shoulders of the builder, who, *ex confesso*, had honestly and fairly performed his duty. If the plan were of a character which militated against the laws of matter, and was such as to insure its own defeat, it was the fault of the engineer, and not of the builder, whose contract could only be held to extend to a covenant to make good those casual defects which might be caused by wear and tear, or by the insufficiency of his own work. The defendant, therefore, submitted that he was entitled to the verdict on these facts; but at all events he trusted that the award might be set aside, and an opportunity given to him to go down to trial with certain pleas averring those facts on which he relied, in order that the solemn decision of the court of error might be obtained on the case.

The Court, however, without much hesitation, unanimously refused the rule. The law of the case was too clear to admit of a doubt. The defendant bound himself to keep a bridge in repair for a period within which it fell down. *Primâ facie* he was bound to rebuild it, and the only question was whether that construction could be varied by the context of the contract. The language, however, did not appear on examination to admit of such a solution. The defendant had the plan before him, and and the specification too, and though it was probable that he confided in the skill of the engineer, and never for a moment contemplated the possibility of the bridge falling down through the defective nature of the plan, yet if he meant to guard against such a state of things, he ought to have done so expressly. It might be a hard case; but the law was so, and the defendant was bound to make good the bridge. With regard to the second branch of the application, it was enough to say that it could never be listened to except in cases of doubt. Here there was no doubt whatever on the bench as to the liability of the defendant, and it would be idle to allow further litigation with such a view of the case on the mind of the Court. For these reasons, therefore, there must be no rule.

Rule refused.

MISCELLANEA.

NEW HOUSES OF PARLIAMENT.—Mr. Barry, Mr. De la Beche, and Mr. Charles H. Smith, the three Commissioners who were appointed by the Crown in 1839, to examine and report upon the quarries of this kingdom, and to select a proper stone suitable for the New Houses, which report is to be found in our journal, vol. 2, 1839, have received instructions to make another inspection of the quarries of Great Britain, both of stone and British marble, and to report upon the qualities of the stone already used in the New Houses, and as to the sufficiency of supply for the remainder of the building, or if there be any other stone more suitable than that now used, either for the exterior or the interior. We anticipate much valuable information in this report, which if only equal to the first, will be received with high approbation by the profession—the three Commissioners have already started on their tour of inspection.

IRON FRIGATES FOR THE NAVY.—We are glad to announce that Government have given orders for the immediate construction of two iron steam frigates, one of 900 tons to be built by Messrs. Ditchburn and Mare, of Blackwall, and furnished with engines by Messrs. Maudslays and Field, and the other vessel, of 1300 tons, to be built by Mr. Laird of Liverpool, and furnished with engines by Messrs. Fawcet and Co,

STEAM NAVIGATION IN FRANCE.—A letter from Brest states that the five steam frigates which are intended for the trans-atlantic navigation between France and the United States, are ready for sea, and will commence service in the spring; and that the French West India Steam Company are going to have a regular line of packet ships between Havre and the Brazils, besides touching at all the West India Islands. The first packets will commence running in May next.

THE WEST INDIA MAIL COMPANY'S STEAMER "THE SEVERN."—This vessel is reported to have made a trial trip at Bristol, from King's-road to Ilfracombe, and it is stated she steamed at the rate of 9 to 10 knots an hour.

THE RED ROVER.—This fine steam vessel which runs between London, Herne Bay and Margate, has undergone a thorough examination, and considerable increase of speed has been obtained, the engines are by Messrs. Boulton, Watt, and Co. This vessel has always proved to be of the first character.

NORWICH AND LEAMINGTON RAILWAY.—This branch of the Birmingham Railway is about to be commenced and pushed with vigour during the ensuing summer.

THE THAMES TUNNEL.—In the first month after the opening, 450,000 passengers have passed through.

BRISTOL AND EXETER RAILWAY.—This line will be opened to the public in a few days, to Beam's Bridge, two miles to the South of Wellington.

VALUE OF MANURE IN LARGE TOWNS.—A new contract has recently been signed, by which the contractor agrees to give £22,000 per annum for the contents of the cess-pools of the city of Paris, which are at present deposited in a place in the suburbs, called Monfaucon, but are about to be conveyed by a new drain five miles further from the city.

Sir John Guest and Co. have contracted with the Russian government for 45,000 tons of railway iron, and it is not improbable that this order will be doubled,

TURKEY.—Messrs. William Fairbairn and Co. have furnished designs for a large building, to be erected for the Grand Sultan in Turkey, for the purposes of a woollen mill, dye-works, &c. It is to be built of iron and wood.

A NEW KIND OF GAS.—The *Censeur*, of Lyons, states that, at one of the late sittings of the municipal council, a trial was made of a new portable gas, to which its inventor has given the name of "hydroluminous." The apparatus, says this journal, is very simple, and applicable to the smallest candlesticks, as well as to the largest and most splendid candelabra. The light it gives is very fine, and it is so portable that it can be carried about with the common hand candlestick. Nothing is said of the comparative cost of this new light.

THE IRON COLONNADE AT MANCHESTER intended to carry the Liverpool and Leeds Junction Railway over the valley at Hunt's Bank, Manchester, is 738 feet in length and 24 feet wide, supported on 52 cast-iron columns, each weighing four tons, carrying 40 main girders, averaging 6½ tons each; on these rest the longitudinal girders 86 in number, varying from 2½ to 5½ tons each, eighteen feet above the level of the street below. The whole will be fenced off on the side next the prison by a cast-iron screen, eleven feet high, the top of which will be seven feet above the rails. The style adopted, and which is in accordance with the massiveness required, is a modification of the Egyptian. The columns, with the mushroom-formed head, from which springs the favourite reeded capital of Egyptian architecture, stand upon stone basements, which project about one foot above the pavement, and give firmness and solidity to the whole appearance. The quantity of iron in the whole structure will be about 1,020 tons.

BRADFORD WATER WORKS were let to Messrs. Brook and Hardy, for the sum of nearly £6,500.

A very rich vein of lead ore has been disco[illegible]d at the Shropshire Bo[illegible] Mines on the property of Henry Lyster Esq.

The grand staircase now building at Devonshire-house will be entirely composed of Italian marble. The estimated expense is £10,000.

AN ENORMOUS PUMPING ENGINE.—A steam engine is now in course of construction at the celebrated Hayle foundry in Cornwall, for the Government of Holland, to drain the Lake of Haerlem, which is of far larger dimensions than any yet built. We have seen a sketch of the engine, which consists of a double cylinder, one within the other, the external cylinder is to be 144 inches in diameter and 12 feet high, and to have an annular piston with 4 piston rods; in the centre is a smaller cylinder of the same height 84 inches diameter, with a piston rod 13 inches diameter; in this last cylinder the steam is to be first admitted under the piston at a high pressure, and then allowed to escape into the external or larger cylinder, and act upon the upper surface of the piston, the five piston rods support an immense cast-iron cap said to be weighted to equal to 18 tons. The steam cylinders stand in the centre of eleven pumps, each pump is 63 inches diameter, 12 feet 6 inches long, and 10 feet stroke; the present pump rods are suspended to the ends of cast-iron beams 32 feet long placed radially to the centre of the steam cylinders, and the other end of these beams come in contact with the under edge of the steam cylinder cap, so that as the cap descends it depresses one end of the beams and raises the other end, and with it the pistons of the pumps. The weight of water lifted will be equal to 85 tons per stroke, if all the pumps were in work at one time.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM MARCH 25, TO APRIL 27, 1843.

Six Months allowed for Enrolment, unless otherwise expressed.

Nicholas Henri Jean Francois, Comte de Crony, of the Edgware-road, Middlesex, for "*improvements in rotary pumps and rotary steam engines.*"—Sealed March 25.

Robert Faraday, of Wardour-street, Soho, gas fitter, for "*improvements in ventilating gas burners, and burners for consuming oil, tallow, or other matters.*" (A communication.)—March 25.

Sir Samuel Brown, knight, of Blackheath, commander in Her Majesty's navy, for "*improvements in the construction of breakwaters, and in constructing and erecting lighthouses and beacons, fixed and floating, and in apparatus connected therewith, and also in anchors for mooring the same, which are applicable to ships or vessels.*"—March 27.

John Sylvester, of Great Russell-street, Middlesex, engineer, for "*improvements in producing ornamental surfaces on or with iron, applicable in the manufacture of stoves and other uses, and for improvements in modifying the transmission of heat.*"—March 28.

Arthur Dunn, of Rotherhithe, soap boiler, for "*improvements in treating, purifying, and bleaching fatty matters.*"—March 28.

James Fletcher, foreman at the works of Messrs. W. Collier and Co., engineers, for "*improvements in machinery or apparatus for spinning cotton and other fibrous substances.*"—March 30.

Frank Hills, of Deptford, manufacturing chemist, for "*improvements in steam boilers or generators, and in locomotive carriages.*

Paul Provost Brouillet, of Hadley, Middlesex, gentleman, for "*improvements in apparatus for warming apartments.*"—March 30.

John Aston, of Birmingham, and William Elliott, of the same place, button manufacturers, for "*improvements in the manufacture of covered buttons.*"—April 4.

Joseph Browne Wilkes, of Chesterfield Park, Essex, Esq., for "*improvements in treating oils obtained from certain vegetable matters.*"—April 4.

George Johnston Young, of Bostock-street, Old Gravel-lane, Wapping, engineer, for "*improvements in the construction of capstans.*"—April 5.

Edwin Whele, of Walsall, Stafford, for "*an improvement or improvements in machinery for preparing wicks used in the making of candles.*"—April 6.

James Boydell, junior, of Oak Farm iron works, near Dudley, iron-master, for "*improvements in manufacturing bars of iron with other metals.*"—April 7.

Robert Hawthorne and William Hawthorne, of the town of Newcastle-on-Tyne, civil engineers, for "*improvements in locomotive engines, parts of which are applicable to other steam engines.*"—April 7.

John Michell, of Calenick, Cornwall, for "*improvements in extracting copper, iron, lead, bismuth, and other metals or minerals from tin ore.*"—April 11.

James Napier, of Hoxton, Middlesex, dyer, for "*improvements in preparing or treating fabrics made of fibrous materials, for covering roofs and the bottoms of ships and vessels, and other surfaces; and for other uses.*"—April 11.

Moses Poole, of Lincoln's-inn, gentleman, for "*improvements in the manufacture of ornamented lace or net.* (A communication.)—April 11.

Uriah Clarke, of Leicester, dyer, for "*improvements in the manufacture of narrow elastic and non-elastic fabrics of fibrous materials.*"—April 11.

William Tindall, of Cornhill, ship owner, for "*improvements in the manufacture of candles.*"—April 11.

William Runwell, of Bowling-green-row, Woolwich, artist, for "*improvements in machinery or apparatus for registering or indicating the number of persons which enter any description of carriage, house, room, chamber, or place, and also the number of passengers and carriages that pass along a bridge, road, or way.*"—April 13.

William Henry Smith, of Fitzroy-square, civil engineer, for "*improvements in the construction and manufacture of gloves, mitts, and cuffs, and in fastenings for the same, which may be applied to articles of dress generally.*"—April 19.

Charles Tayleur, and James Frederick Dupré, of the Vulcan Foundry, Lancaster, engineers, and Henry Dubs, also of the Vulcan Foundry, engineer, for "*improvements in boilers.*"—April 19.

James Byrom, of Liverpool, engineer, for "*an improved system of connexion for working the cranks of what are commonly called direct action steam engines.*"—April 19.

Carl Ludewick Farwig, of Henrietta-street, Covent-garden, tin-plate worker, for "*improvements in gas meters.*"—April 19.

John George Bodmer, of Manchester, engineer, for "*improvements in locomotive steam engines and carriages to be used upon railways, in marine engines and vessels, and in the apparatus for propelling the same, and also in stationary engines, and in apparatus to be connected therewith for pumping water, raising bodies, and for blowing or exhausting air.*"—April 20.

John Rand, of Howland-street, Fitzroy-square, artist, for "*improvements in the manufacture of tin and other soft metal tubes.*"—April 20.

Edward Cobbold, of Melford, Suffolk, master of arts, clerk, for "*improvements in the means of supporting, sustaining, and propelling human and other bodies on and in the water.*"—April 20.

Thomas Oram, of Lewisham, Kent, patent fuel manufacturer, and Ferdinand Charles Warlich, of Cecil-street, gentleman, for "*improvements in the manufacture of fuel, and in machinery for manufacturing fuel.*"—April 20.

James Johnston, of Willow-park, Greenock, esquire, for "*improvements in the construction of steam boilers, and machinery for propelling vessels.*"—April 20.

Richard Prosser, of Birmingham, civil engineer, and Job Cutler, of the same place, civil engineer, for "*improvements in the machinery to be used in manufacturing of pipes and bars, and in the application of such pipes or bars to various purposes.*"—April 20.

John M'Innes, of Liverpool, manufacturing chemist, for "*improvements in funnels, for conducting liquids into vessels.*"—April 20.

Francois Constant Magloire Viollette, of Leicester Square, Middlesex, late advocate, for "*improvements for warming the interior of railroad, and other carriages.*" (A communication.)—April 22.

Richard Greville Pigot, of Old Cavendish-street, gentleman, for "*improved apparatus for supporting the human body when immersed in water, for the purpose of preventing drowning.*"—April 25.

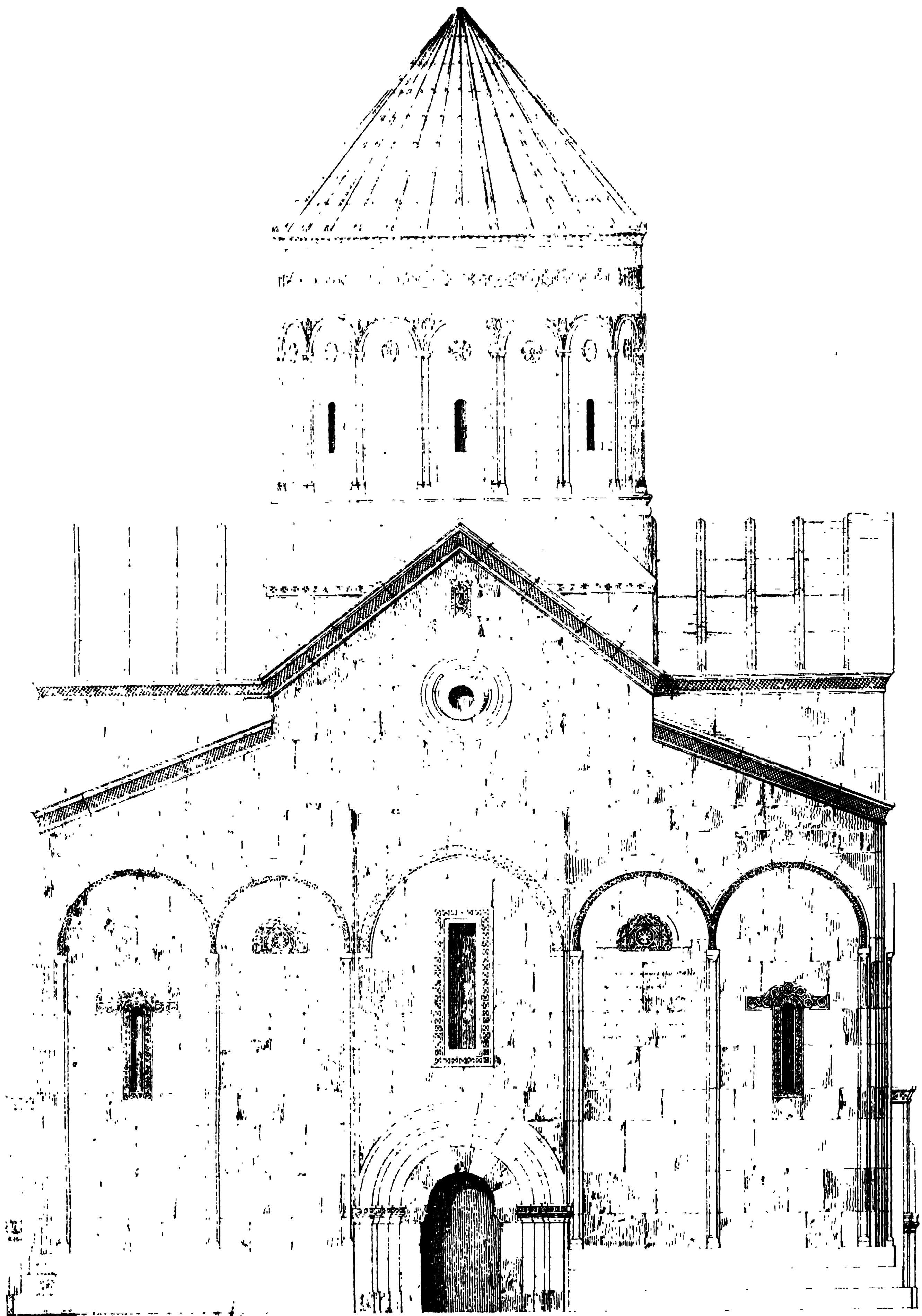
James Moon, of Milman-street, Bedford-row, surveyor, for "*improvements in the manufacture of bricks to be used in the construction of chimneys and flues.*"—April 25.

William Brockendon, of Devonshire-street, Queen's-square, Middlesex, gentleman, for "*improvements in the manufacture of wadding for fire arms.*"—April 25.

William Mayo, of Lower Clapton, Middlesex, and John Warmington, of Wandsworth-road, Surrey, gentlemen, for "*improvements in the manufacture of aerated liquors, and in vessels used for containing aerated liquors.*" (A communication.)—April 25.

Charles Forster Cotterill, of Walsall, Stafford, merchant, for "*improvements in the progressive manufacture of grain into flour or meal; the whole or part or parts of which improvements may be applied to the ordinary method of manufacture.*"—April 27.

John Winspear, of Liverpool, ship-smith, for "*an improved mode of reefing certain sails of ships, and other vessels.*"—April 27.



ANI CHURCH IN ARMENIA.

Description of a church at Ani in Armenia, translated from the "Revue Générale de l'Architecture," 1842, *p.* 102.

(With an Engraving, Plate VII.)

By Professor Donaldson, Vice-President.

(Read at the Royal Institute of British Architects.)

Amongst the ruins of Ani are two churches in an almost perfect state of preservation, upon which Armenian writers have expressed both their censures and praises. We can form a sufficiently correct notion of the extent and character of the monuments mentioned in history. From the enthusiastic manner in which the Armenian authors speak of the metropolitan church at Ani, it would appear that it was considered one of the *chefs d'œuvre* of Armenian architecture, and that this temple was the type of all the religious edifices afterwards erected throughout Armenia.

At the time that the princes of the family of Pagratides were in tranquility, they removed their seat of dominion to Ani. Aschod I. received the royal crown of Armenia from Osdigan Ysa, in the fortress of Ani, in the year 885 of our era. Ten years later, Sempad, his son, added fresh possessions to his inheritance. He was, however, taken prisoner by the Arabs, carried to Tovin, where he died in torture. The throne of Ani was not, however, shaken by this blow; the Greek emperors signed a treaty with Aschod II., and the Armenian princes redoubled their exertions to render Ani a formidable station. Its situation was naturally strong, and they added fresh fortifications. I shall now examine in detail the most important edifices of these ruins. So long as Armenia was addicted to the superstitions of the East, she was the more naturally led to borrow from the arts of Persia, the elements of her national architecture. But when the preaching of Gregory the Illuminator had had its due effect, when the Armenians abandoned their ancient faith and adopted with ardour the Christian religion, a breach arose between the two people, which was signalised by wars and massacres, which terminated in an interested, if not sincere, alliance between the Armenians and Greeks of Byzantium. Whatever concerned the new religion, became an object of common interest to the two Christian nations. The Armenians had, perhaps, outstripped the Greeks, in their submission to the new law, but the ardent spirits of the latter were not satisfied with a mere speculative faith; they built churches and monasteries in all parts of the country, which came within the communion of the faithful. It was like a forcible possession, which the reactions of Paganism sometimes shook, but which they could never recover. We may trace in the progress of Byzantine architecture, the gropings of the first Christians to find a temple, which might give as a whole a striking symbol of Christianity. During five centuries, the Christians sought, without appearing to be satisfied. Hence it arises that in the religious monuments of the four first ages, is found the greatest variety, if not taste. They are, in fact, ancient temples, with the porticos closed to form the nave. At other times all the peristyle of the temple is enclosed within an exterior wall, and thus the Pagan edifice becomes an immense basilica. Some bishops built circular churches, or rather, as at Hieropolis, the church is formed of a certain number of beams simply covered by a roof, such as are now used for warehouses and sheds. After the fifth century, light broke in upon the Christian artists, which tradition expressed, saying that an angel had appeared to Justinian, in order to trace out for him the plan for his new temple, which model has been alone imitated, to the exclusion of all others throughout the whole Byzantine empire. There is no trace amongst the Armenians of this natural progress of an original genius. Being always the vassal empire of a foreign people, it yielded unconsciously to the influence of its neighbours, and adopted their arts and literature. We are unacquainted with the style of the Christian art in Armenia during the first seven or eight centuries of our era. The undecided character of the people was evident in all their compositions. Some of them are, however, not devoid of elegance, but in all there is a deficiency of strength and severity of character. The chief defect among the Armenian artists, was their ignorance of what we may call feeling for proportion, and not knowing how to adopt with propriety the ornaments of the masses of which they formed the decoration. Hence it results that the aspect of their buildings presents a cold and mean appearance, for there is no play of light and shade to give value to the large surfaces which only present small columns, without relief, on which the eye may repose.

This defect was not chargeable to the Byzantines, who generally sought in the façades of their buildings to produce striking effects of light and shade, by placing some harmonious relief between the surface of the solids and voids. The delicacy of detail was generally sacrificed to the mass, the proportions of the columns were rather heavy than slight, and they endeavoured to gain the height by raising the semi-circular arch one-fourth of its diameter above the springing. We recognise this character particularly in the edifices of the period of Basilicus and of Constantine Monomachus. The Armenians evidence in their choice of ornaments, more of the Arab than the Roman taste. All their details are executed with great delicacy. The use of columns is very restricted, they are usually engaged and take the place of pilasters. One of the edifices in the town of Ani, in which is found isolated columns, was constructed during the period when the Arabs were masters of Armenia; it is the monument near to which is a minaret, which I consider the principal mosque. Other columns belonging to the porch of a church, also, have capitals of the Arab character.

Upon surveying the circuit of the walls of the town, we récognise the exaggeration of the chroniclers of the times. Matthew d'Edessa thus expresses himself, in speaking of the royal city: "In 1064 the sultan Alp-Arslan, brother of Toghrul Bey, determined to conquer Armenia, and encamped before the royal city of Ani, which was then in the possession of the Greek Emperors. This town contained an immense population, and a thousand and one churches where mass was said." John Alathir, the Arab historian, records the same fact, but only mentions five hundred churches. "Arslan fixes the siege of Ani in the year 1064. This town was protected by two deep vallies; it contained some magnificent monuments, and one might count in it more than five hundred churches." To judge from the present ruins, it would be difficult to conceive that the number of temples dedicated to the Christian religion exceeded fifty, even including the baptisteries and the altars of cross-ways with their pictures.

But this people, who never had the instinct for great works, were satisfied with admiring monuments which are useful to study as the history of art, but which must not be compared to the edifices of the East, to the vast Latin basilicas, nor even to the mosques of Ismalism, erected by the Turkish or Seldjioukides sultans.

The peculiar character of the religious architecture of the Armenians, is the exclusion of the spherical cupola, which is replaced by a conical ceiling. This species of construction applied to the edifices of Ani, is also found in a great number of Arab tombs, in Cappadocia, which was in the possession of the kings of Armenia for several centuries. As these monuments are of a more recent date than those of Ani, there is reason to believe that the Seldjioukides adopted the spirit of the Armenian monuments.

The plan of the metropolitan church of Ani is composed of a nave, with transepts, in the centre of which is placed a dome, and side ailes. The entire length of the church is 105 feet, and its width 65 feet 6 inches, that is to say, the proportion of the edifice does not exceed those of some of our village churches. The dome is supported by four pillars composed of a group of shafts *(feiseaux)* which run up to the impost, and which are carried up so as to form a Gothic arch.

The lateral arches, which separate the nave from the side ailes, have their imposts at half the height of the large, isolated pillars, and the higher arches spring from engaged pillars, the shafts and projections of which correspond with the isolated pillars. The choir is composed of a hemicycle, which is decorated with ten small niches, divided from each other by double columns. The altar is placed in

the centre of the hemicycle, as is customary in the Armenian rites. A wooden screen, called by the Greeks *Khangelon*, extended from one extremity of the hemicycle to the other; it is to this screen that the curtains and tapestries, of which mention is frequently made, are attached. To the right and left of the hemicycle are two small sacristies, one to preserve the gospels, the other to contain the sacred vases; such is the simplicity of the plan of this edifice. Its decoration consists in paintings, which, however, time has destroyed; there now only remains in the choir some traces of the figures of the twelve Apostles. The whole of the interior of the church was covered with stucco, which has fallen off gradually. The central lantern is at this time dilapidated, the fragments have accumulated in the centre of the church; it is possible to recognize the greater part of the exterior decoration, and the system of covering is precisely the same as that of a neighbouring church, of which the lantern is still perfect.

The stucco in falling has laid open the stone used in the construction of the pillars. It is a volcanic tufo, which has the property of hardening on exposure to the air. The courses of the pillars are formed of alternate yellow and black stone, which recal certain constructions of the thirteenth century in Italy. This taste of zones of various colours was very general among the Mussulmen of Syria and Egypt. In Cairo, they are still careful [illegible] to paint on their mosques horizontal bands with [illegible] [illegible]ed lime and red ocre, but in other towns in the East these [illegible] zones are made with different coloured stones. The first impression which is produced on entering this half destroyed nave, is a feeling of melancholy, on witnessing the nakedness of the stone and the coldness of the lines. The narrowness of the side ailes apparently increases the thickness of the pillars. But painting formerly enlivened these high walls, and the small quantity of light shed on the nave when the cupola was complete, must have given to the interior of this temple a melancholy and austere tone, which was in harmony with the grave character of the people who frequented it.

Those, who have observed the progress of the arts in the middle ages in Europe, will be disposed to consider this edifice as a work of the thirteenth century; it indeed bears the characteristics: but the date inscribed on the portal proves it to be far more ancient, and that the pointed arch was in use in Armenia at the period when the Roman style was the only one which was adopted in Europe.

The façade of this church, constructed with remarkable simplicity and decorated with great reserve, presents, however, an interesting subject, as it may be regarded as the type of the German architecture of the middle ages. It is easy to explain why, throughout this country, is found the dome with the conic roof peculiar to the Armenian architecture. After the taking of Ani by the Mussulmen, a great number of the citizens abandoned the town. They could not retire into Persia, where they would have been received as enemies. The Greeks in Byzantium, being equally hostile to them as the Persians, it was towards the North country they directed their steps. They were received by the kings of Georgia, and spread themselves over Moldavia as far as Poland, where they formed different establishments. All these countries, which were still immersed in ignorance, availed themselves of the knowledge brought to them by these new comers. Although a religious spirit was dominant among the Armenians, they were too timid to make any effort to promulgate their doctrines. The rising Christianity of those countries borrowed of them what they could adopt of their arts, but remained faithful to the ritual of the Greek church. The style of this architecture progressed by degrees towards the North. It was from them that the Russians imbibed their first elements.

The façade of the church is in harmony with the simplicity of the plan. All superfluous ornament is excluded. Slight engaged columns on the face of the walls support circular arches, which are raised a little above their centre. The middle arch, on the contrary, approaches the pointed form. Two semicircular panels to the right and left of the window, present to the eyes of the faithful the image of the cross, placed in the middle of an hexagonal star, surrounded by a foliage of flowers.

The three divisions of the nave are indicated outwardly by a pediment, which adjusts itself with the wall of partition of the cross, and by the two slopes of the roof which cover the side ailes.

This arrangement of the upper part was often employed in the churches of the middle ages in Europe. It is the most simple and logical arrangement. The cornices are composed of slightly projecting mouldings, separated by a rather broad fascia, decorated with a Greek scroll. Below the summit of the pediment there is another bas-relief, in the middle of which is a Latin cross placed in a richly sculptured frame.

This grouping is frequently repeated in various ways on the doors, monuments, and exterior walls. It was not only at Ani that this custom prevailed, the principal towns of Armenia were also decorated in the same manner. Ibn Alather, in his chronicle, makes frequent mention of this peculiarity. The town of Matian Neschin was surrounded by a wall composed of large stones, and ornamented with crosses fixed with lead and iron. The quarries of Ani furnished materials of various colours: they availed themselves of this opportunity to execute crosses in yellow and black mosaic. The façade of the church participated in this polychromatic decoration; but we cannot conceive what induced the builder of the church to work in, in an irregular manner, black and yellow stones promiscuously in the wall of the elevation. The quarries which produced the stones for the church are sufficiently abundant to have furnished all the materials they required. Three windows afforded light to the nave; that in the middle is square, surrounded by a broad framework, the two side windows are hardly wide enough to give light to the side aisles. There is an inscription on one side the door in the Armenian language, which states that the metropolitan church of Ani was built by Queen Gadramia, wife of King Kakig, the first successor of Sempad who laid the foundations of the edifice in the year 1010 of our era.

Hence it appears that at the time the pointed arch was unknown in Europe, monuments of the Gothic style were constructed in Armenia. At Diarbekir there is a very remarkable monument, which is now converted into a mosque, also constructed in the Gothic style. The Armenians call this edifice the palace of Tigranes, and there is nothing to disprove its having been the residence of this prince. The ground floor of this palace is embellished with columns in the Roman style, with Corinthian capitals of tolerably correct workmanship; these columns support a range of Gothic arches. The order of the first story is also Corinthian much enriched; the frieze and cornices are formed upon the principle of the Roman arch in the fourth century; the Gothic arch is, however, mixed up with this architecture, so as to indicate its common use in these countries. Although it is difficult to fix the precise date when the pointed arch was first used in architecture, we cannot form any positive conclusion as to the date of the monument in which it is found. Up to the present time this question is far from being decided, but it is very certain that the pointed arch is of eastern origin, since it may be traced in Mesopotamia long before it was known in Europe.

As to the arch greater than the semicircle, which we are accustomed to regard as Saracenic, it is of such rare occurrence in the West, that its eastern origin cannot be contested. It appears certain that it was first introduced into Europe by the Moors, but it may be observed in the eastern buildings, even before the birth of Mahomet. The Armenian church of Dighour presents a remarkable example of this kind of arches, their curve or rather the elevation of the centre above the line of impost is much more decided than in the church at Ani. It bears the date of 1164.

The lateral front of the metropolitan church at Ani is constructed in the same style as the principal front. The gable end of the cross is enlightened by a circular window, as on the façade: under this window is a kind of tympanum or table with a Gothic arch. This table projects very little, and has no particular decoration. To the right and left of the door there are two very elongated niches, or rather two species of sinkings, which correspond with cavities in the engaged columns. The same adjustment may be observed in the back elevation of the church. But there it is more defined, as it disengages the cir-

cular end of the hemicycle from the two side sacristies. This disposition is characteristic of the architecture of Ani. It may be noticed in the other church, which is in much better preservation than the cathedral, but which was not so much esteemed by the Armenians. No traces are to be found amongst these ruins of any staircase, nor of any vaults for purposes of sepulture. It was, however, the custom of the Armenians to inter the dead in churches, for we read in the geography of Vartan, that "the body of Gregory the Illuminator was brought from Constantinople, and was placed in a grave under the four columns of the church." The same author mentions a great number of relics found in the churches and monasteries.

One striking circumstance in this architecture is the ingenious manner in which the inhabitants availed themselves of the materials placed within their reach. The roofing is constructed with an art equal to that, which has produced the finest monuments of antiquity. The large tiles made of lava have their edges turned up at right angles, like the tiles of marble used in the temples, these two ends, applied one against the other, are covered by a continuous capping, and the whole is supported upon a stone vaulting. Hence it arises that in the construction of the edifice no wood has been employed, and although abandoned for five or six centuries, the edifices of Ani have suffered little from the effects of time. It is, in my opinion, a remarkable feature in Armenian architecture, to have been conceived in accordance with the materials so immediately within reach. Wood being scarce in the country, the use of it was entirely excluded. As lime is a substance very uncommon in volcanic formations, they learnt to do without it, whilst tufo of different consistence and divers colours were cut, chiselled, and sculptured in walls and capitals, in columns and vaultings, in great variety.

The century which followed that of the erection of the cathedral, witnessed the decline of the town of Ani, which fell into the hands of the Byzantine princes, who already possessed Kars and Erzinghian. The church, which was situated close to the river, appears to have been consecrated to the Greek ritual, as they had added before the entrance a portico or vestibule, which was always placed in front of the churches of this communion.

The two lower courses only remain of the lantern, but all the other fragments are heaped up in the nave. The lantern has been restored from these fragments, and from those of a neighbouring church which is exactly similar to that of the cathedral. The dressings of the door are also very little injured, the rest of the edifice is in perfect preservation. The whole of the monument is constructed of yellow and black lava.

ON THE CORINTHIAN CAPITAL.

Observations upon the very marked and varied style of composition exhibited in the capitals appertaining to the Temples of Jupiter Stator, and of Mars Ultor, and to the interior of the Pantheon at Rome.

By A. W. Hakewill.

The first and paramount duty of the architect being to select an appropriate form or outline for his building, he next considers the detail, with a view to give to the outline a suitable expression.

It is proposed, in the following observations, to take into consideration the subject of detail only, moreover directing attention to one sole feature of ornamental detail, viz., that triumph of human invention, the Corinthian Capital, with a view then to show how bent the ancients were upon giving expression to their works, in order that these, if it may be so expressed, should speak a peculiar and suitable language, it may be well to cite those admirable examples of the Corinthian Capital, left us by the Romans. But prior to entering upon the merits of particular examples of the Corinthian Capital, it may be allowable to refer to the composition itself, commencing with the account of its origin; and here we are indebted to Vitruvius for a simple and elegant story, the spirit of which, it must be confessed, is quite in harmony with the beautiful object to which it relates, and if not taken too literally, but on the contrary, properly entered into, will be found like most of the allegories of the ancients, to contain an important truth.

We are told that a maid of Corinth having died, her devoted attendant seeking consolation in the last sad offices, collected the favourite trinkets of the departed into a gracefully elongated basket, which she carried to the tomb, and secured there, by placing upon it a square tile, it so happened that a young acanthus shot up close to the spot, and entwined its leaves round the basket,

> 'Flexile around its sides the acanthus twin'd,
> Strikes as a miracle of art the mind."
>
> Theocritus.

that the ends of the delicate stems meeting with resistance from the overhanging stone at the top, bent gracefully down, resolving themselves into spirals, which altogether produced so much of symmetry and variety of form, that the artist Callimachus, who chanced to see the composition, made a representation of it, and reduced it to the Corinthian Capital.

The graceful spirit of this metamorphosis will, of itself, secure to it an abode in our minds, but its utility gives it the greatest claim to our attention, linked as the story is with so masterly an invention in the ornamental department of architecture, it reminds us forcibly that art to be striking, must spring from the contemplation of nature; but not exactly from that species of contemplation inferred by this ingenious tale, which can be viewed in no other light, than as a graceful fiction setting forth the first principles of invention, it is to contemplation of a far more mental and abstracted kind, that we stand indebted for the ingenuity and grace exhibited in the design under consideration, we leave no scope to intellectual vision in this affair, and wholly discard originality, if we view it as a matter of fact, and yet there have not been wanting those who have inserted this story in their works, as a credible manner of accounting for the origin of the Corinthian Capital, whilst others have gone still further, and rendered it ridiculous, by graphically illustrating the subject, presenting us with the whimsical group of Callimachus with his basket of leaves. The inventive faculty requires no such broad hints, nor such palpable suggestions, but suggests powerfully itself, and from the slightest incidents the primary objects which inspire an artist's thoughts, stand in no nearer relation to his matured conceptions, than do the juices gathered by the bee, to the honey to which she finally converts them.

First principles form the basis of his conceptions, but the power of combining is wholly dependent upon originality of feeling, and when taste and judgment are united to invention, then it is that the objects created assume that natural and easy aspect which prompts us to assign their origin to some production of nature, thus the graceful Ionic capital is said to be in imitation of a peculiar style of female head dress, the groined vaulting in Gothic architecture to the interlacing of the boughs of a grove of trees, and because the Corinthian capital does not exist in nature, we go about to make up a most improbable story, we require a trick, a harlequinade on the part of nature, merely because we are unwilling to admit the truth, and pay just homage to the inventive faculty of man.

While discoursing upon the Corinthian Capital, it may not be amiss to remark upon the simplicity of the design itself—simplicity, that essential quality, the inseparable concomitant of all that is beautiful in nature and art, enters largely into the composition of this graceful work, nothing can be more easily understood than the plan of the Corinthian Capital, two circular tiers of leaves, one tier placed above the other, the centres of the upper leaves, corresponding with the spaces separating those of the lower tier, a stem giving birth to spirals jutting out at each of the four angles, the whole surmounted by a slab, concave on its outer edges, constitute this striking architectural feature, albeit the parts are few, still the effect is great; there is no appearance of effort, this is the result of simple intelligent arrangement. These are the lessons which teach us to value the sentiment so winningly expressed by the poet, when invoking simplicity he says—

"The flowers that sweetest breathe,
Tho' beauty culled the wreath,
Still ask thy hand to range their order'd hues
Collins.

With a view to pursue the inquiry, the nature of which has been stated at the commencement of the foregoing observations, we may proceed to investigate the capital of the three remaining columns adjacent to the "Arco de Pontani," at Rome, in which we perceive at once a vigour of style truly surprising, so that we are in a great measure prepared for the discovery of its being a feature of a temple, dedicated to Mars the avenger, let us now direct attention to the means which are resorted to in this work of art, in order to its rightly affecting the mind of the spectator, we are made to feel that the pourtrayal of sentiment alone has been resorted to for that purpose this intellectual aim absorbing every other less worthy consideration.

The Corinthian Capital had been frequently applied before this version of it appeared, and its usual mode of composition is strictly adhered to in this instance, the artist positively bringing nothing new to his aid save conception and style, and this circumstance alone invests it with abundance of novelty, we perceive, too, in this example, how entirely the artist has depended upon expression for the effect he aimed at producing; to be convinced of which, we need only bear in mind, how little the elements which enter into this composition relate to the attributes of the god of war, it is the spirit which those elements breathe which so affects the mind, and raises in it sensations so in harmony with the subject.

Thus conceived a fragment strikes the mind, whereas whole rows of entire capitals composed of spears, shields, thunderbolts and forked lightning, which elements, a false taste would readily substitute in this instance as more appropriate features, would have absolutely failed to make an impression, for the reason that such objects from their rigidly defined forms cannot by any possibility be made the vehicle of sentiment. Let us now restore in our minds this work to its pristine form and beauty, and picture to ourselves a number of them executed in a beautiful and durable material, borne aloft upon graceful pillars, which surrounded on all sides the temple, these seated upon noble base and podium, and supporting sculptured frieze and pediment, the whole viewed under the influence of a brilliant atmosphere, and we behold a spectacle which the Romans gloried in, and which must have lifted their hearts to the utmost pitch of patriotic devotion, overawing at the same time the enemies of the state, by the demonstration it afforded of the lively sympathy entertained by the Romans for the avengeful spirit of the god of war.

It is interesting to know that this relic of ancient art was a great favourite with the immortal Michael Angelo, who was wont whenever he passed by it to express his admiration of its style, the turbulent character of which reminds us of what Agostino Caracci says of that of the great Florentine, "di Michel Angiolo la terribil via," for in truth the style of this capital assimilates with the dread manner of Michel Angiolo. Such productions as these, of which there remain but too few in Rome, were congenial to the mind of that extraordinary man, and the contemplation of them no doubt greatly aided in developing his bias for the sublime. The following description of this temple by Sir Christopher Wren, is to be found in the "Parentalia," viz., "As studiously as the aspect of the 'Temple of Peace' was contrived in allusion to Peace and its attributes, so is this of Mars appropriated to war, a strong and stately wall of near 100 feet high is placed behind it, (because, as Vitruvius denotes, things appear less in the open air,) and though it be a single wall, erected chiefly to add glory to the fabric, and to muster up at once a terrible front of trophies and statues, which stand here in double ranks, yet an ingenious use is made of it—to obscure two irregular entrances which come from a bending street; and to accommodate itself as well to the situation, as to give firmness to the wall, but five feet thick, it is built in various flexures, (because a straight wall is easier ruined by tempests), these flexures give opportunity to form two other frontispieces, in which are seen niches much greater than ordinary, and may be supposed to contain the trophies. Thus stands the temple like the phalanx, while the walls represent the wings of a battalia;" and further in the same work, we have, "this and the Temple of Peace and the Pantheon, are those which Pliny particularly mentions among the most remarkable works of Rome."

Now if we institute a comparison between the above-mentioned capital, and the one appertaining to a building known by the appellation of Jupiter Stator, we shall find that they exhibit a marked difference of style. This last mentioned building was devoted to state purposes, such as the reception of ambassadors, the discussion of foreign affairs, and contained also the treasury; in order then that the style of this building should respond to its intention, it became necessary to invest it with a character expressive of Roman sumptuosity, which demanded throughout the details a display of unusual magnificence. We cannot sufficiently admire the intelligent manner in which this desideratum is obtained, for though in richness it borders on the very brink of redundancy, still there is nothing about it ungracefully gorgeous. In expression it differs wholly from the capital we have just been contemplating; yet the composition remains the same, as regards its essential features; nothing is retrenched, and nothing very important added, the only embellishment attempted that the other does not possess, consists in some delicate ornament upon the abacus, and the stems of the volutes. Although vigour of expression is not the aim in this instance, there is no lack of that quality richness and grace are, however, the predominating characteristics of this bewitching production, independently of the extra embellishment already mentioned, which concurs in producing this effect, the individual leaves of the capital take a more lively and graceful form but the most pleasing circumstance in this respect is the entwining the central spirals or volutes this is truly a touch of inspiration, one of those thoughts that rarely occur, and then only in the artist's happiest mood, exemplifying most happily what is meant by "snatching a grace beyond the reach of art."

If we now pass to the consideration of the capital of the interior of the Pantheon, we shall find that it differs entirely in expression from the two we have already noticed, in those some one quality predominated, the vigorous or the graceful, in the present example those qualities are softened and blended into one another. It is gratifying to view these proofs of the mind disporting in the sphere of invention, passing boldly from extreme rigor and sublimity of conception, to that of gracefulness and delicacy of sentiment, then seeking, as it were repose in the calm atmosphere of tranquil thought, it is to be observed that the interior of the building to which this capital attaches is chief ornament, is of a circular form a form more susceptible than any other of producing tranquil emotions in the mind of the spectator, the absence of all angles, with the uninterrupted continuity of line, have this tendency. Upon this subject it will be allowable to quote Sir C. Wren, who says, "no inclosure looks so graceful as the circular, 'tis the circle that equally bounds the eye, and is every where uniform to itself, but," he adds, "being of itself perfect, is not easily joined to any other area, and therefore seldom can be used."

We have now to bear in mind that the Pantheon was a temple dedicated to all the gods, the characteristic of the presiding deity being conveyed through the expression of dignified repose; the result, then, to be obtained in the interior of the Pantheon was, that in that mansion of the gods, the spirit of tranquillity should reign undisturbed, and that the spectator admitted within its precincts, whilst contemplating its wonders, should experience kindred emotions of the mind. It became important, then, that each and even the smallest detail should be designed in a way to contribute to this result; hence the quiet style of composition of so prominent an ornamental feature as the capital. It may here be repeated that the object proposed in the foregoing observations was that of showing how desirous the ancients were of rendering art expressive, and making it the vehicle of language, mute if we will, but not the less eloquent; and that they set more value upon novelty of sentiment than upon novelty of form; it is this intelligent manner of the ancients of treating architecture, that gives that life to their buildings, which makes even the decaying forms of the latter so attractive; as we gaze upon their fading beau-

ties we are transported alternately by feelings of joy and sorrow; we imbibe their spirit, and seem conscious for the moment, of a new life, and to exist in the past. It is this intellect breathed throughout the works of the ancients, which makes them even in their decayed and ruined state so valuable as studies. He who can sympathize with the feeling which gave birth to those works, is possessed of a safe and faithful guide in the study of architecture.

The importance of the architect's well considering the style and expression of his building, is manifest, since he is bound by the laws and spirit of his art to aim at originality. We all feel that buildings possessing a suitable expression, never fail to arrest attention and inspire interest; but when they are shorn of this essential and soul-stirring attraction, they are passed by, as piles of hard materials, and nothing else, as a dead letter, not a language. It is to be observed, that the capitals of the three orders of architecture, owing to the conspicuous part they play in a building, and their being so susceptible of modified expression, with strict attention to the preservation of their original form and meaning, are admirably calculated both to receive and reflect a full impression of the character which it is sought to display, the same thing holds good in detail generally. If this be borne in mind in designing, novelty will occur as often as the destination of the building varies—and this circumstance should act as a warning to those persons who, thinking but casually upon art, are apt to taunt architects, with the slavish disposition of copying the ancients, because they make use of similar elements. In the way those persons mean, the ancients were copyists also, for they the ancients repeatedly imitated themselves. When at last the elements of classical architecture became defined, they were adopted as the elements of the art, and adhered to; and to adorn them with new and ever varying sentiment, became the study of the most imaginative amongst the ancients. Thus there are no bounds to the power of invention, save those which reason alone imposes—there is absolutely no such thing as being compelled to copy, all nature tells us so. Marvellous as the economy of nature is in adhering to forms created from the beginning, still she is continually presenting us with novelty, in the varied expression of those very forms. Thus as regards the human countenance, though one and all of the millions created are based upon the same foundation, what variety does it not present: we know the formation and construction of the features of the human countenance to have been the same from the creation of man to the present time, the infinite variety which it exhibits depending *entirely* upon expression, and who would wish for greater novelty? In this wondrous restraint, which all powerful nature imposes upon herself—in this marked economy of invention it is, that we see revealed much of the awful wisdom, which pervades all her works. *Sage novelty*, then, is the essence of invention, and in looking at those works of art which have furnished the subject matter of the foregoing observations, we are penetrated with the conviction that the artists who created them were inspired with a feeling akin to divine; that they possessed minds wherewith to explore nature's secrets, and to listen to her councils, for they have worked upon her plan; they have shown us by the marked variety which they have achieved in the repetition of one single object, the *true road* to novelty; let us then pay high homage to the works of antiquity; and this, not by servile imitation, but in taking them as guides to a higher source of learning, viz., the study of nature, thus, shall we, like the ancients, be enabled to seize that true spirit of originality, which acts as the Promethean fire, imparting to their wondrous works all their life and energy.

SOUTH-EASTERN RAILWAY.—Another explosion at Acre Flat, Dover, took place on May 5, for the purpose of removing another portion of the obstructing cliff. Forty barrels, or 4000 lb. of gunpowder, were employed, and disposed in three mines, two of which were 150 feet from the top, and driven in 50 feet, the lower one 200 feet, and driven in 30 feet. The mines were sprung by two 20-plate batteries, fired by Mr. Hodges. The effect of this explosion is precisely similar to those produced by the others which preceded it. It is everything the parties could desire. About 15,000 yards, or 30,000 tons, of chalky cliff have been dislodged by this operation.

THE AERIAL TRANSIT MACHINE.

Analysis of the projected Aerial Transit Machine, and of the principles involved in its construction and employment.

(Continued from page 153.)

In our last number we endeavoured to exhibit in the most striking point of view some of the leading characteristics of that member of Mr. Henson's Aerial Transit Machine, by the intervention of which he purposes to accomplish its suspension and effectuate its transportation through the air. We showed that, presuming an angle of inclination considered most favourable for the success of the experiment, it would be necessary, in order to secure a permanent elevation in the atmosphere, that it should realise a rate of motion ranging from 240 to 280 miles an hour,[1] and this, virtually subservient to the relation between the weight of the machine and the superficial dimensions of the suspending plane alone. We say *virtually* subservient, because in fact these are the only elements of the case by which the degree of velocity necessary to maintain a continuous flight is essentially determined for although an inferior velocity would suffice with a larger angle of inclination, this result would only be attained at the expense of a *more than equivalent* amount of propulsive force, the real bearing and effects of which will be considered when we come to treat of the *power* by which the apparatus is to be set in motion.[2] And this will serve to show the futility of those observations so copiously hazarded, respecting the probable attainments of the machine in regard of speed, some arguing for the possibility of a high rate, others contending for the necessity of a low one, some asserting that 100 miles an hour was not beyond the reach of its means, and others labouring to prove that 15 or 20 miles an hour, or the speed of the crow, was the utmost it was competent to realise; as if the rate of its

[1] An erratum of some consequence occurred in the former part of this article which was not observed in time to have it amended in the text; and as some copies were disposed of before the deficiency was supplied by the insertion of a note, we desire to avail ourselves of this opportunity of extending the correction. By an oversight, which we can only account for by the fact that the article in question was not completed till the day before it was published, the resistance in opposition to gravity developed by the passage of inclined planes through fluid media, was computed to vary in the ratio of the *cubes of the sines* of the angles of impact instead of the *squares of the sines into the cosines* of the same terms, whereby the rate of the machine necessary to maintain its elevation was considerably overstated. The proposition omitting the consideration of the cosine (which in so small an angle may be regarded as unity,) should have been enunciated thus; As rad = 1 : 05 — ·0025 : 3000, the resistance in pounds equal to its weight developed by the plane at right angles to its course, moving with a velocity of 12 miles an hour : 7·5, the vertical resistance generated by the same plane at an angle of 3°, moving at the *same* rate; and, consequently, as √7·5 = 2·74 : √3000 = 55 : : 12 : 240, the actual number of miles per hour requisite to the support of the machine, near the surface of the earth. This quantity, to suit the diminished pressure of an altitude of 8000 feet has to be further increased in the ratio of √3 : √4, from whence a rate of 280 miles an hour is deduced as the ultimate rate of the machine necessary to its complete success. It is in fact the *horizontal* resistance that follows the ratio of the cubes, while the *vertical*, or that opposed to gravitation, observes the ratio of the squares of the sines into the cosines of the homologous angles, and it is in this that consists the advantage of the principle involved in the plan before us, the former, which is the resistance opposed to the progress of the plane, diminishing so much more rapidly than the latter, which entirely contributes to its support.

[2] It is to be observed, that we have here made no account of the resistance which the solid parts of the machine are calculated to experience in their forced passage through the air, and of the influence which this resistance has in determining the conditions of its support. This will be more properly considered in the inquiry hereafter to be entered into, with regard to the moving power. In the mean time, we would merely observe that, the immediate effect of this new force, is to impose a slower rate of motion upon the machine, not as equivalent to its support, but as the result of an increased horizontal resistance, to be met and answered by an enlarged angle of inclination and an increased development of moving power. It will easily be seen that the omission of this force from our consideration hitherto, though apparently diminishing the requirement of velocity, does not present the difficulties of the case in an exaggerated, but in a really mitigated point of view. However diminished the rate in respect of this additional force, it will still require more power to accomplish it than the 240 miles an hour we have here abstractedly assigned to it.

progress was a voluntary accomplishment, independent of its support, and not the veritable means of that support itself, determined by the conditions of the case alone. These conditions we have shown to be the *weight* and superficial dimensions of the suspending plane and by these conditions, in the present case, observing an inclination of 3°, we are referred to a velocity of 240, or more properly 280 miles an hour. A modification of these conditions, involving an enlargement of the surface or a diminution of the weight, is therefore, and absolutely, the only existing means by which any part of this velocity could be *effectually* dispensed with, a modification which, moreover, we showed to be equally necessary to its success in another point of view, the accomplishment, namely, of its descent, consistently with the preservation of human life, or even of the integrity of the machine itself. It only remains, on this head of inquiry, therefore, to make a few remarks respecting the particular *form* which Mr. Henson has adopted for this important portion of his aerial apparatus.

Where so much more is required to be done than can be easily accomplished, and the utmost that we can reasonably hope to arrive at is a very limited reduction of the essential difficulties of the case, a lack of proper economy in the disposition of our resources becomes a grievous error, and inevitably leads to the conclusion that chance or mistaken analogy rather than the legitimate inductions of science have had a share in determining the choice. To those who have not considered the matter or made it the subject of actual experiment, it may not readily suggest itself that the really effective obstacle to the accomplishment of an aerial navigation, upon the principle of the plan before us, consists in the difficulty of constructing a rigidly extended surface, of sufficient dimensions and sufficiently light to answer the purpose required of it. Apart from this there is literally nothing that interferes, nothing that has to be overcome for in the attainment of this object are merged all the obligations in respect of *power*, which the want of it alone imposes, and which constitutes in its default the existing obstacle to success. The difficulty which is here alluded to, and which, be it observed, is interposed by nature herself, in the essential properties of matter, depends upon the ratio in which weight, or rather, its effects in pressure, increase in respect of the distance at which it is suspended from its fulcrum or point of support, and the impossibility of counteracting these effects by the intervention of any means which do not also add to the forces, by the operation of which their adoption in the first instance was required. The conditions of weight, and consequently the obligations of support, increase, as we all know, in the ratio of the leverage, or horizontal projection, and this with such effect, as very soon to confound the best directed efforts of the most ingenious architect to combine solidity and lightness with extension in a plane of any magnitude that is devoid of extrinsic sources of support. With these inherent and inevitable peculiarities, it scarcely needs to be observed, the main object to be aimed at by those who have occasion to construct a surface in which the qualities in question are required to be carried to their extremest degree, is to have a form for that surface the most compact, in which the largest area is contained within the least remote limits; an advantage which the circular above of all others is pre-eminently calculated to afford. In Mr. Henson's scheme, however, this has been entirely lost sight of, and, for what purpose it would be hard to conjecture, a form has been adopted, in which the smallest extent of surface is obtained in conjunction with the fullest development of all the natural difficulties by which the case is peculiarly beset. The stringency of this observation will be the more readily perceived when we consider that the utmost amount of surface which Mr. Henson has been able to accomplish, (for we will not suppose he has stopped short of his ability in this most essential ingredient of success,) involves an extension of 75 feet on either side the centre of support, within which limits, had he adopted the circular form, he might with equal facility have comprised an area of exactly four times the extent, the very quantity we have already shown to be the [illegible]th which it would be possible to enable it to come with safety [illegible]e ground.

Besides this, there is another objection to the shape of Mr. Henson's plane, which deserves to be noticed; namely, the superfluous amount of horizontal resistance to which it is calculated to give rise. The force of resistance, it is well known, depends upon the direction of its development—is greatest when it is perpendicular, and diminishes with the obliquity of the impact. Now the whole of the resistance experienced by the opposing front of Mr. Henson's plane, is of the former description, and consequently the greatest it could by any possibility be made to encounter. Without pretending to form any estimate of the actual amount of this force, we shall merely observe that by the adoption of a circular or even an elliptical form, the greater part of it would have been effectively avoided.

Nor must the question of danger be altogether overlooked in criticising the properties of Mr. Henson's plane. Depending entirely for its stability upon the due strength and tension of the cords by which it is supported, it is easy to see how precarious must be that form of structure which at once involves the fewest number and the greatest length, where the whole weight, situated in the centre, is sustained by levers in one direction only, and where, consequently, the rupture of a single line of braces must be attended with the collapsion of the whole mass and its unrestrained precipitation to the earth.

To complete this survey, we will only add one more objection, which, though we have placed it last, is by no means the least characteristic of those to the charge of which Mr. Henson's plane, in its present form, is liable, we mean the obstacle to its rectilineal motion, arising out of the exaggerated inequality of the forces which it is calculated to develop in its progress. If the opposite sides of the suspending plane be in any way productive of different amounts of resistance in passing through the air, (and no precision attainable by art can prevent this conclusion in some degree,) this difference acting continuously and through the intervention of a lever of 75 feet in length, will create a re-action destructive of the regularity of its progress, which it will require the application of considerable powers to be able effectually to counteract. Supposing, for instance, (what may inevitably be apprehended,) that a dislocation or distension of any of the numerous bracings by which the rigidity of the plane is to be secured, should occur on either side of the machine more than on the other, an alteration in the obliquity of the presentation of the sides must ensue, and a disturbance of the equilibrium of resistance, which if it be only equivalent to ten pounds (and at the rate of 210 miles an hour, the perpendicular resistance upon a single square foot of surface, would be equal to 286 pounds) at the distance of 75 feet from the centre of motion, would influence its course with a diversion equivalent to a pressure of 750 pounds, and acting continuously, occasion a constant tendency to move in the circumference of a circle, only to be resisted by a rudder of suitable dimensions, to the manifest retardation of its speed, and the consequent expenditure of a considerable amount of power.

Why Mr. Henson should have fixed upon this form for the construction of his suspending plane, we cannot pretend to surmise. All we can say is that, if it has been designed with a view to preserve any analogy with the bird whose wings appear to be similarly extended in flight, the design is founded in a mistake. The bird requires its wings to be laterally extended, that they may operate to the greatest advantage in effectuating its propulsion through the air. This purpose, however, in Mr. Henson's plan, is intended to be answered by another expedient, namely, the revolving vanes. To retain the form after the purpose has been superseded, is to defeat not to sustain the analogy designed.

We have not stopped to examine the various modifications which have been proposed in different quarters by way of improvement upon this part of Mr. Henson's machine. Two only of these modifications we would particularize, because they have emanated from, or obtained the sanction of, one justly celebrated for his scientific attainments, and especially in matters relating to the present subject. the first consists in doubling the amount of surface, by placing *two* planes, one over the other; and the second, in the adoption of a conical or curved surface, as it were sunk a little in the middle, instead of one perfectly plane, with a view to escape the os-

cillations which are otherwise apprehended to ensue. With regard to the former of these, there is no doubt the conception is just; but a closer consideration shows it to be impracticable. We have no hesitation in declaring that it would be absolutely impossible to construct two planes of sufficient magnitude, sufficiently remote from each other to allow them to be freely impinged upon, with sufficient strength to maintain that position so completely as to form but *one* object with reference to the power by which it is to be moved, consistently with any thing like the lightness that would be necessary to qualify it for the purposes of mechanical flight. With regard to the second, if it is meant to propose as a model the plan, of which a sketch is given in the number of the *Mechanic's Magazine* for the 8th of April, the same objection would apply. It would be quite impossible to construct it, or anything like it, of the proper size and strength, within the limitation of weight required by the essential conditions of the case. To which we would add, that we are inclined to consider the provision itself uncalled for. If a plane could be constructed of any form sufficiently light and large to serve the purposes of flight, it would be difficult to prevent it from assuming of itself a form analogous to that proposed. But we are, moreover, sceptical as to the properties ascribed to it, and the advantages which it is said to hold out. The freedom from oscillation which bodies of that form are stated to display in their progress through the air, and for the illustration of which we are referred to the case of the shuttlecock, we conceive arises partly from the additional distance of the centre of gravity below the plane of suspension, (which its form obliges, but does not restrict,) and partly from the diminished resistance it offers to the descent; no very great recommendation, one would suppose, where that propensity is the main difficulty to be overcome. But, in truth, the simplest form in all these cases is the best; and if a circular or elliptical surface cannot be made to answer the purpose required of it, it will be in vain to seek for it in a more elaborate construction or a more complex form. And thus much for the suspending plane.

II. The next in order of the parts of Mr. Henson's aerial apparatus which we have proposed to discuss, are the controlling appendages or fan-like expansions, the purposes of which are, as we are given to understand, to regulate the vertical and horizontal movements of the machine, and present an obstacle to the oscillations to which it is expected to be subjected in its course. And first with respect to this latter purpose, the appropriate instrument of which is a vertical web of considerable superficial dimensions, extending from the front to the back of the machine, bisecting the suspending plane, the mode by which it is designed to operate is, we presume, by the resistance to its displacement, which it would experience in the re-action of the surrounding air. Now this resistance, be it observed, is entirely independent of the particular position of the resisting surface, and would have been equally attainable, had it been horizontally instead of vertically displayed; in other words, had the projector, instead of appropriating to that end a special instrument, made an equivalent addition to the suspending plane. To this must be added, that by a vertical arrangement, an opposition is afforded to the oscillations, which tend to occur in one direction only; whereas, had the latter alternative been adopted, all the oscillations which could occur would have been equally provided against, while at the same time additional efficacy would have been conferred upon that part of the machine where it is most required. To have devoted a large, or *any* portion, of his resources to the accomplishment of a single purpose, and that of doubtful and secondary importance, when it might have been made equally conducive to another, and that most exigent and essential, argues a great neglect of economy in those particulars in which its unqualified observance is absolutely necessary to success, and a disregard, to say the least, of those principles upon which the operation of the chief members of the machine depends. It is exactly as if a person having only two horses, and a carriage which their united efforts were but just sufficient to move, were to keep one of them always in reserve, for the purpose of attaching it behind occasionally, when the carriage was going down a hill.

By the intervention of the second of these controlling appendages, we are likewise informed, is to be governed the ascent and descent of the machine in its onward course, and the mode in which we are given to understand this is to be effected, is by some disposition of it, similar to that of the tail of a bird, enabling it to regulate within certain limits the horizontal inclination of the suspending plane. Now in respect of this, the least we can say is, that it is an expedient equally unnecessary and inapplicable with the preceding. The position of a plane suspended *in equilibrio*, is a matter so readily affected, that he must have strange notions of the conditions of the case, who conceives it necessary to make a provision for the purpose in an extensive and cumbrous apparatus. It is not in fact by any modification of construction or application of special machinery that the object in view is necessarily or properly to be accomplished; but by a disposition of the appended weight equally simple and secure. A few shovels full of coal thrown from the front to the back of the fire, or the transfer of any of the aerial passengers from one part of the car to another, would at any time effect a change in the position of the whole floating mass, far more necessary, indeed, and difficult to guard against than to accomplish; and from the smallness of the angle of inclination, more than sufficient for the purposes which could ever in that behalf be required. For it is not, in truth, by any such modification of the *position* of the suspending plane that the ascent and descent of the machine is to be properly governed, but by a modification of the *force* with which it is propelled. The suspension of the machine *in transitu*, being the result of the development of a certain amount of resistance in the air opposed to gravitation, which resistance varies with the rate, and consequently with the force under which it is generated at a given angle, the conditions of this suspension, affecting the level of the machine's course, follow the exercise of this power; so that having a force equal to the propulsion of the machine at its highest elevation, its reduction to a lower level is the natural and simple consequence of a reduction in the energy of the force employed, and *vice versa*, any modification in the obliquity of the plane which might be necessary to second this movement, being more than sufficiently attainable by the occasional disposition of the appended weight as before explained.

But the adoption of this device, sufficiently extravagant, even if conceived with a just notion of its effects, becomes doubly preposterous, when viewed in the light of a contrivance, not only unnecessary and inapplicable to the purposes for which it was intended, but absolutely producing its effects in direct contravention of the anticipated results of its operations. For what are the consequences of the modification in the obliquity of the suspending plane, to be brought about by the agency of this caudal appendage, as described by Mr. Henson, in the specification of his machinery, and inconsiderately adopted by all those, without exception, who have taken upon themselves the office of enlightening the public upon this interesting subject? Totally overlooking the circumstances upon which the actual suspension of the machine depends, and regarding it as it were a body endowed with the power of following with equal facility any course towards which it might happen to be directed, all alike concur in considering the disposition of the inclined plane as giving (so to speak) the *cue* to the appended body; so that having attained an elevation in the bosom of the air, all that is necessary to increase that elevation is to augment the angle of inclination, and, *vice versâ*, to diminish the elevation, it is only requisite to decrease the inclination of the suspending plane. Now the whole of this reasoning is false, and the consequences in fact directly contrary to what they are here represented. So far from the direction of the plane indicating and controlling the course of the machine in the way described, paradoxical as it may appear, the modifications in question would be productive of exactly opposite results; as will be evident to those who consider the conditions upon which the support of the plane *in transitu* is really dependent. The resistance developed upon the under surface of the plane and resolved in a direction opposed to gravitation, which is the true grounds of its support, following the ratio of the *squares* of the sines into the cosines of the angles of inclination, while the horizontal resistance, which is the measure of its propulsion, varies as the *cubes*

of the sines of the same angles, any alteration in the obliquity of the plane must affect the latter more extensively than the former, and determine a balance in favour of that condition which is most in conformity with the change; if it be to *diminish* the horizontal resistance (which is the result of a diminished angle of inclination), increasing the relative effects of the vertical, which is the medium of support; and if to *increase* the horizontal resistance, (which is the consequence of augmenting the inclination) to disparage the vertical resistance, and incontinently subtract from the ascensive powers of the machine. Accordingly, therefore, if the machine be progressing with a given force, and it be desired to *rise*, this result will be accomplished by *reducing* the inclination of the suspending plane, and on the other hand, if the angle in question be *enlarged*, it will immediately begin to *descend;* the rate in the former instance increasing and in the latter diminishing with the alterations in the obliquity of the plane, and the accompanying alterations in the level of its course.

With regard to the remaining purpose of these controlling appendages, corresponding to the horizontal steerage, of the aerial vessel, but little needs to be observed. Having no forces to contend with which operate to favour one direction more than another, except such as may arise from the unequal resistances occasioned by the opposite sides of the machine itself, any amount of artificial resistance beyond what is thus indicated, if properly applied, is sufficient to give a preponderance to any course which may be chosen; the only advantage of a more liberal supply being in the limitation of the space within which it enables the aeronaut to effectuate his purpose—an advantage of no great consideration in the abundant regions of the sky. In this respect the case of the aerial machine is most favourably distinguished from that of the ship at sea, pursuing her course under the influence of the wind; where the force by which she is propelled being frequently oblique, and in a sense adverse to the direction of her route, she requires a *given* power, not only to *obtain* a course but to *keep* it, and the conditions of which are governed by those of the force to be opposed.

It only remains to observe, in answer to the objections of those who imagine that, in the tenuity of the medium, exists an impediment to the efficiency of the rudder, that these objections are founded upon an imperfect consideration of the principles of the case involved. The impediments to the efficiency of any instrument are equally dependent upon the obstacles to be overcome as the means of overcoming them. Where these arise out of the same conditions, there can be nothing in the conditions themselves to influence in either way the success of its operations. And this is the case exactly with respect to the guidance of the aerial machine by means of the rudder. The obstacle to be overcome and the means of overcoming it are the same—namely the resistance of the air; in proportion as the weakness of this condition operates to disparage the powers of the rudder, in exactly the same proportion does it operate to disparage the forces by which the action of the rudder is opposed.

III. We now proceed to examine the third subject of investigation which we proposed to ourselves in the outset; namely, the revolving apparatus, by the reaction of which the impetus is to be maintained, which is to determine the progressive motion of the machine. These instruments may be most succinctly described as both in form and operation resembling the rotatory portion of a windmill, only consisting of *six* arms instead of *four*, about 10 feet long (the breadth not stated) and inclined to the plane of their revolution at an angle of 45 degrees. Being two in number (one on each side of the centre of gravity) in the same plane, and facing the direction of the intended route, that part of the resistance they are calculated to generate by their forced rotation which is perpendicular to the plane in which they revolve, becomes available to the propulsion of the machine, and constitutes, in fact, the measure and the means of its success. As it is clear, by the obliquity of the impact a certain quantity of the force which is developed becomes resolved in directions not favourable to the object in view, before any thing can be pronounced with certainty as to the efficiency of the means at command, it must be determined how much of these means is really turned to account—how much is realized and how much lost in the process by which it is conveyed from the source to the object upon which it is intended to act.

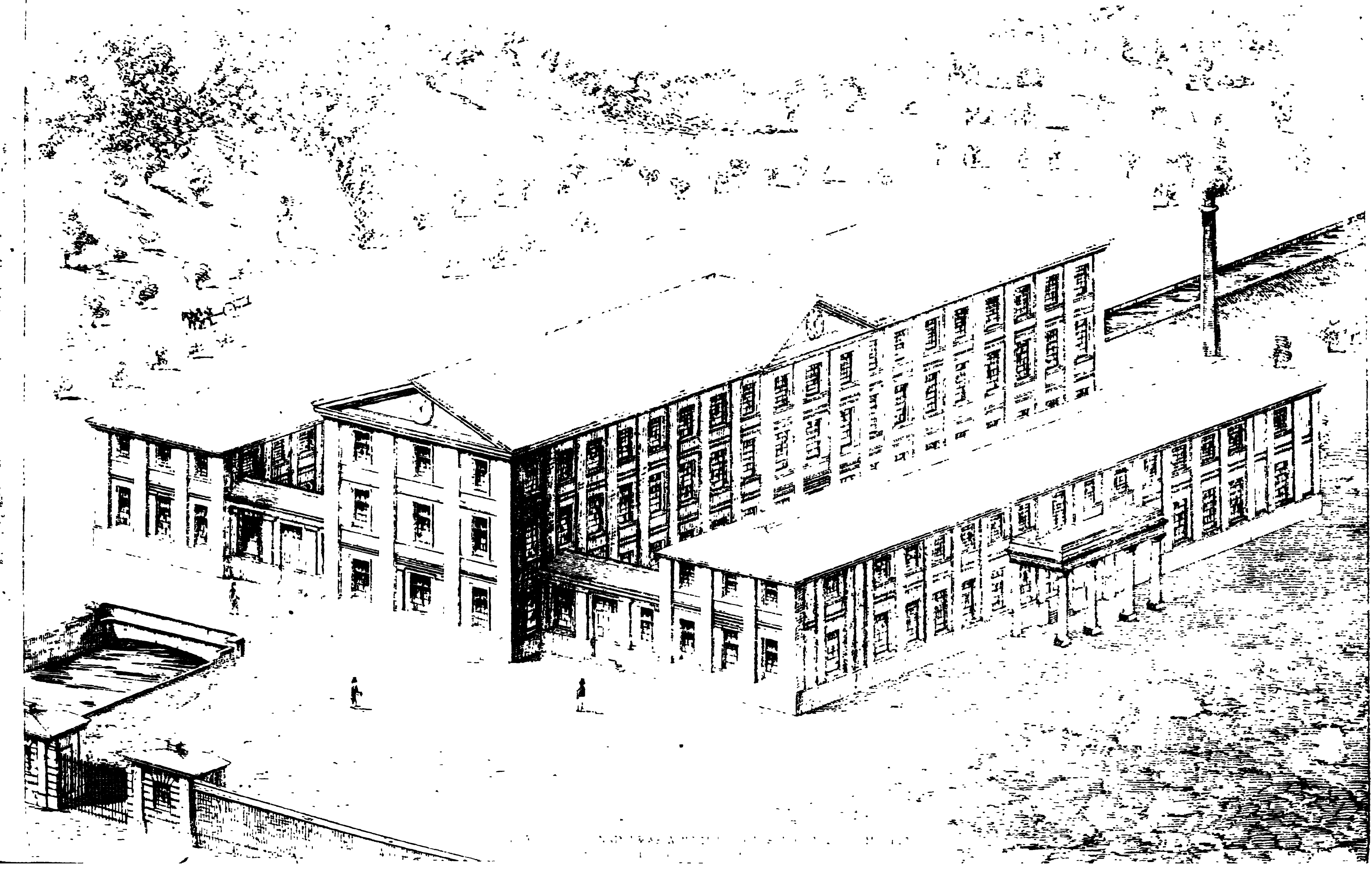
In determining the efficiency of any system of impinging planes, there are *three* elements concerned in the constitution of the force developed, which require to be considered—the *angle* of inclination, the *number*, and the *size* of the impinging surfaces.

Of these elements there is one only the actual amount of which is independently determinable—we mean, that does not regard the other conditions of the case, but has its *maximum* effect assignable with reference to itself alone—and this is the *angle of inclination.* Whatever this be that may be found to be best suited to the purpose, it will still continue to be the best under all modifications of size and number, rate of motion and condition of medium, which may happen to characterize the case. Now this angle, (that whereat an inclined plane is calculated to develop the greatest amount of resistance at right angles to the direction of the impinging force,) has been already determined, both by mathematical induction and actual experiment, in a strictly analogous case; namely, that of the windmill, in which the conditions both of the object and of the means are precisely the same: for it will not be considered to constitute any difference, whether the plane be impelled against the air or the air be directed to act against the plane. In both cases the object is to develop the greatest amount of atmospheric resistance at right angles to the direction of the impact; and the angle at which this is complete has been established to be an angle of 54° 44′. The arguments, both mathematical and experimental by which this conclusion has been sustained, may be found in most works upon pneumatics; but we abstain from quoting them here, because we have a shorter way, and more open to the comprehension of the general reader, by which the same is ascertainable, and which, moreover, by the almost perfect coincidence it presents with the result deduced from other sources, serves at once to illustrate and confirm the correctness of the general inference. We have already had occasion to observe that the ratio of the degrees of vertical resistance, developed by inclined planes moving horizontally, (which is exactly analogous to that the conditions of which we are now investigating) follows the ratio of the squares of the sines into the cosines of the angles of inclination. Accordingly whatever be the angle of which the sine squared, multiplied by the cosine, is the greatest, the same must also be the angle most favourable for the production of the required resistance. This actual computation enables us to fix at 54° 46′, differing only by *two* minutes from that otherwise assigned; as any one who pleases may verify for himself by consulting a table of natural sines, and applying the test to the corresponding sines and cosines of the angles, differing only by one minute on either side, taking four places of decimals in the estimation of the quantities concerned.[3] By what process of reasoning Mr. Henson was led to adopt, for his impinging vanes, an angle of 45° we cannot presume to conjecture; unless, observing that in the opposite conditions of perfect parallelism and direct uniformity of plane, answering to the angles of 90° and 0°, no available resistance at all was generated, he came to the conclusion that the proper resting place was the half way house between. Be this how it may, by assigning an angle of 45° as the inclination of his impinging planes, he has exactly sacrificed *one twelfth* of the whole amount of his resources, as may be seen by comparing the sines squared multiplied by the cosines of the angles of 45° and 54° 46′ respectively, which are subjoined in the note below.[4]

With regard to the two remaining elements of the case referred to, the *number* and *size* of the impinging planes, the amount of their effects in action being not only governed by an indefinite power of arrangement (being themselves unlimited in extent by any specific terms), but moreover, (in theory at least) entirely subject to the influence of another condition—the rate of their operation, it is clearly

[3] The products of the sines squared multiplied by the cosines of the angles of 54° 45′, 54° 46′ and 54° 47′, are respectively ·38483, ·38488, and ·38477; whence it is apparent that the *turning point* is the intermediate angle.

[4] The sines squared multiplied by the cosines of the angles of 45° and of 54° 46′ are respectively ·35347 and ·38488, which is very nearly in the ratio of 11 to 12.



impossible precisely to define the actual quantities or proportions of each which are calculated to produce the greatest amount of resistance available to the purpose in view. But though we are thus precluded from appointing any specific terms to the size and number, in like manner as we have been able to do with respect to the obliquity of the impinging planes, yet are there certain considerations by which these conditions are affected, and under which a rough estimate may be formed of their efficiency or aptitude to perform the work assigned to them. These considerations are drawn from the properties of the medium, and the obligations of speed imposed upon the aerial vehicle by the already stated exigencies of its support. It is well known and easily conceivable, that when surfaces of any specific dimensions are set in motion, a disturbance of the equilibrium of the density of the air must ensue proportioned to the extent and speed of the impinging planes. Now if the system of planes by which this disturbance is effected, should be so constituted as that they come in succession into the same or adjacent portions of the atmosphere before this equilibrium shall have been restored, they no longer operate in or act upon a medium of equal resistance to that by which the other conditions of the case are governed, and upon the hypothesis of which their own effective power has been calculated; and in fact, if this state of things be extreme, so that either by reason of the proximity of the planes or the rapidity of their succession, they pass over the space allotted to them in the same or less time than the air takes to rush into a vacuum (which is at the rate of about 1330 ft in a second) they would no longer have any medium at all to act upon, and consequently be productive of no amount of reaction, however great their number or their size. To mitigate these consequences there are two modes of proceeding; either to increase the distance between the planes, or to diminish the velocity with which they are impelled. Now to the latter of these we are precluded from having recourse by two considerations: first, by the general consideration that, as *rate* is the condition of impact upon which the actual amount of the resistance of a given plane entirely depends, to subdue the rate is to impair the efficiency of the machine *essentially* and without regard to any particular disposition of its parts; and, secondly, because a rate of motion the highest, probably (if not indeed higher than any) that will be found attainable, is required by the condition of rate assigned to the aerial vehicle itself, which rate must at all events be *equalled* by that of the instruments of its propulsion, for it requires no great process of reasoning to perceive that by no appointment of propulsive machinery can a body be endued with a greater rate of motion than that at which the propelling agents are themselves proceeding, so that it will be readily admitted the contemplated relief cannot with propriety be expected from the diminished speed of the impinging vanes. To increase the distance between them is therefore the only available means of sustaining the propulsive energy of the revolving apparatus, which in a construction of prescribed dimensions can only be accomplished by restricting the number; and the only question that remains for our discussion is, whether this condition has been sufficiently regarded in the plan before us. Now this question can be answered satisfactorily by reference to experiment alone, to experiment, with the particular machine in the process of its construction, or to general experience in operations of the same description. To the former of these, of course, we have no means of referring, but to the latter we have happily some pretensions; and in accordance with that experience, we have no hesitation in alleging a very great redundancy in the number of the impinging vanes in Mr. Henson's propelling apparatus, viewed with reference to the special object for which they are designed. Indeed, so convinced are we of the prejudicial influence which even *one* superfluous member in a system of revolving vanes is calculated to exercise over the effective product of their impact, that we feel quite assured that had the number of arms been but *three* or even *two*, instead of six, in each compartment, they would have realised under the prescribed conditions of the case, a very superior amount of atmospheric reaction; perhaps the greatest that with an equal amount of surface it would have been possible to have accomplished. We know that to this it may be answered, that in truth the modifications alluded have been tried, and that it was not until the superior efficacy of the larger number had been attested and approved, that the present arrangement was ultimately adopted. But before we admit any force to this conclusion, we must be satisfied that the experiments upon which it is based, embrace all the modifications to which the conditions of the case are liable; that not only has the proper angle of inclination been equally retained throughout, but that the efficacy of the machine has been tested in all cases at its *utmost speed*, and subject to an equable distribution of surface according to the varying circumstances of the case; for there is no doubt that with a subdued rate of motion a larger number of the *like* planes will produce a greater amount of resistance, or that a larger number of planes will produce a greater amount of resistance than a smaller number of the same planes, where the rate of their motion is not such as to require an augmented interval between them to preserve the integrity of the resisting medium.

And here, in concluding this branch of our investigations, we would just briefly warn our readers against a very common and fallacious mode of regarding the operation of this particular sort of instrument, (which may not inaptly be termed the "aerial screw,") by which many are led to overlook or reason away the obstacle here set forth to its success, namely, that this obstacle, arising from a rapid action of the parts in a circumscribed space, would be avoided by the anticipated result of the operation—the progress conferred upon the machine—whereby they would be constantly introduced into fresh portions of the resisting medium; in other words, that the ultimate success of the undertaking will be an efficient means of removing the difficulty by which that success is mainly threatened. The argument is absurd to a degree. It is a *petitio principii* of the most flagrant character; because, not only is the insufficiency of the grounds of the progressive motion of the machine (the impoverishment of the medium) here set forth as the thing to be cured by the result of its own operation, but, the truth is, the very progress of the machine, apart from the operation of the vanes, is itself a main contributer to that deficiency, the effects of which it is expected to repair, in the withdrawal of the medium by the advance of the body within it, imposing fresh obligations of speed upon the agents of its propulsion to enable them to realise the prescribed amount of resistance. It is an argument not merely in a *circle*, but (if we may be allowed to coin a figure) in a *[illegible]*, in which the premises are rendered even *less* consequential by the conclusion which they are intended to support.

We have now left, of the questions we originally proposed to consider with reference to Mr. Henson's scheme of flight, the *power* by which the parts are to be endued with motion, and the *principle* upon which a first impetus is expected to be acquired. The insufficiency of the one and the fallacy of the other we purpose to expose in our next number.

NEW FLAX MILL AT CASSANO D'ADDA, IN LOMBARDY.

(With an Engraving, Plate VIII.)

We give in this number a plate showing a perspective view of the Flax Mill at Cassano in Lombardy, erected under the immediate direction of Mr. Albano, C. E., of London, and which at present is exciting much attention on the continent. To us it has additional interest, as attesting the wide diffusion of English industry, the whole of the millwright work having been supplied from the works of Mr. W. Fairbairn of Manchester, after the designs of Mr. Albano. It serves to show at the same time the field of employment open to the English manufacturer, and the resources available to foreign enterprise, who are thus able to carry out their own plans, and to profit by the proficiency and talent of the best factories in the world.

The following description of the manufactory we extract from a report of Giulio Sarti, the government engineer, who with his colleagues surveyed the building at its completion, on the 31st of December last.

"The general plan of the manufactory consists of three buildings a large one in the centre containing three floors, and two lateral of two floors each one of the small buildings serves to deposit and to prepare the raw materials, the centre one for the spinning, and the third for power-loom weaving. This separation into three buildings is requisite, by the diversity of the processes to be worked, which could not be mixed together in a single building. The ground floor of the whole building contains an area of near 40,000 square feet, and are constructed fire-proof, of this, the main building is formed of two rooms, with a central staircase, the interior dimensions of each being 80 feet in length and 15 feet in breadth, with [illegible] columns in two rows, 14 feet in height, of granite shafts and cast-iron Doric capitals, supporting cast-iron beams, and brick vaults. The first floor is formed of two rooms with cast-iron columns 12 feet, to each [illegible] height, with tasteful Egyptian capitals, and a floor above it, 12 feet high, in the roof of which advantage has been taken to [illegible] reel rooms, which are very convenient in a large manufactory. In consequence of the superior arrangements of the building, it is capable of containing 8000 spindles. [illegible] the motive power of the [illegible] manufactory is an hydraulic breast wheel, worked by water taken from the river Adda, which runs through the building, and has a fall of 9 feet; this wheel is a stupendous piece of mechanism, fit for a model to any manufacturing establishment of the kind. It is 16 feet diameter and 21 ft. wide, the whole of cast and wrought iron of about 36 tons weight, she takes and discharges the water with the most perfect regularity on each side there is a large toothed segment, each working a pinion, which transmits the motion to the [illegible] different buildings. The regular speed of the wheel and transmission of motion are regulated with true perfection, and the mode in which the fixings and supports are fastened to the buildings is such as to guarantee their position unalterably.

"The cast-iron sluice, which admits water to the channel, prevents anything floating into the wheel; the cast-iron cistern and shuttles, (which supply the water to the wheel, according to the greater or less number of machines at work,) together with the speed of the wheel, are regulated by a centrifugal governor; the elevating machines which carry the whole work from one floor to the next above it, the means to supply the boiler with water, and the fire-pump in case of fire, &c., are all improvements which manifest the superiority of such an establishment.

"The spinning machines were chosen after mature consideration, among those possessed by the most celebrated spinning establishments in Europe, that can give in the greatest quantity and finest work, and among those, the preparing ones are admired for containing the most recent improvements.

We regret that in our [illegible] the [illegible] original designs of the machinery, in consequence [illegible] by S. N. S. in our last number, wilfully misrepresenting the [illegible]. On the present occasion we beg leave to call attention to the letters [illegible] spirit [illegible] fully asserting and confirming Mr. Albano [illegible], which ought never to have been disputed.

SIR,—My attention has been drawn to a communication [illegible] by S. N. S. in the last number of your interesting *Journal*, page 181, relating to the Flax Mill at Cassano in Lombardy, [illegible] [illegible] commence by [illegible] to you a [illegible] in the [illegible] number [illegible] that Mr. P. Albano, C. E. [illegible] was the director of the works [illegible] to [illegible] that Mr. Albano was the superintendent of the building of the said [illegible] mill [illegible] work, mill [illegible] &c. were solely constructed by Mr. W. Fairbairn of Manchester.

In the name of justice, Sir, which has been [illegible] involved [illegible] S. N. S. [illegible] the last grain of truth, and as Mr. Fairbairn [illegible] wrote to Mr. Albano [illegible] "*I [illegible] state that I [illegible] connected with [illegible] nor do I know anything of the writer*," I beg to submit to you a short account of the real facts of this case, in which I have been acting as [illegible] for the proprietors of the said mill, and consequently I am [illegible] to place all parties in their right position.

As far back as 1840 I have been commissioned by the directors of the said proprietors to procure of several professional gentlemen in Belgium, Leeds, and London, information and estimates for the construction of a flax mill, and to that effect I applied also to Mr. B. Albano, who furnished full particulars. His plan and report having met with the sanction of the directors, I was further requested to send Mr. Albano to Milan, in order to survey and fix on the proper site for the establishment, which he did, on the express condition, that the direction and execution of the whole work should be entrusted to him without any interference, and accordingly he completed in Milan the required plans, and obtained full sanction thereto, with ample power to execute the work according to his own design.

This preliminary will, I trust, be sufficient to contradict the first part of S. N. S.'s assertion, and I can easily prove the second part equally wrong, when I inform you that upon Mr. Albano's return from Milan, specifications of the required millwright work were sent out to several manufactories in London, Manchester and Dundee for their estimates, and on Mr. W. Fairbairn calling at Mr. Albano's office, the plans were shown to him, in my presence, to which he suggested some organic alterations, but on Mr. Albano's observing that they would increase the expense and be otherwise objectionable, were soon set aside, and Mr. Albano then proceeding with his own plan in all its details, chose with due regard to perfection and economy to give the order to Mr. W. Fairbairn.

To that effect a contract was entered into, the first clause of which stands thus: "With the sanction of B. Albano, Esq., C. E., Directing Engineer of the said Company, &c., the machinery contracted for in the present agreement will comprise the following articles of millwright work, &c. for the organization of the flax and hemp mill of the said company, now in progress of construction at Cassano in Lombardy, under the immediate direction of the said engineer B. Albano. The whole of the following millwright work apparatus, &c. are to be executed strictly according to the disposition shown and dimensions marked in Mr. Albano's drawings, Nos. 1, 2, 3, 4, 5, 6 and 7, and the following specification respectively signed by Mr. W. Fairbairn, contracting parties, and the above engineer."

The mere quotation of the clause demonstrates that the merit of the designs for the whole machinery is intended to belong solely to Mr. Albano, and I may further add, that the whole design is different from the mode generally adopted by Mr. W. Fairbairn in constructing mills, as the architectural style, proportions, &c. of the building, and arrangement of the water wheel and machinery, are essentially original and distinct, erected under Mr. Albano's immediate direction, and pronounced by the body of Government engineers (whose report of their official inspection of the mill I beg to enclose) to be replete with great ingenuity, and conferring the greatest credit to the directing engineer.

The directors likewise highly satisfied with his ability, energy, and personal assistance from the commencement to the last, testified their gratification on the starting of the mill by presenting Mr. Albano with an elegant and valuable gold snuff box bearing an inscription to that effect, and entrusted to his care fresh extensive orders.

Having so much trespassed upon your indulgence, I shall trust to your kind desire to do justice to all parties, the insertion in your publication of this statement of an incontrovertible fact.

3, White Hart Court, City, — Your obedient servant,
May 22, 1843. — HENRY PALANT.

SIR,—My attention has been directed to a letter signed S. N. S. in your last *Journal*, wherein it is stated that Mr. Albano, C. E. had appropriated to himself nearly the whole if not the whole of the merit belonging to the erection of the Flax Mill at Cassano.

Now in justice to that gentleman I beg to state that I know nothing of the writer of the letter above alluded to, and although I may have assisted Mr. Albano in the mechanical arrangements of the mill, I must nevertheless disclaim any connexion with the original project or designs which were exclusively his.

I am, Sir,
Your very obedient servant,
Manchester, May 17, 1843. — W. FAIRBAIRN.

SUBSTITUTE FOR GLAZED FRAMES IN HOTBEDS

In the *Rheinlandische Garten-zeitung* is described a substitute for the glazed frames of hot beds and green houses, which deserves the attention of florists. Instead of glass the frames are covered with a fine white cloth of cotton. In order to render this more transparent, and enable it to resist moisture, it is covered with a preparation, the ingredients of which are four ounces of pulverised dry white cheese, two ounces of white slack lime, and four ounces of boiled linseed oil. These three ingredients having been mixed with each other, four ounces of the white of eggs, and as much of the yolk, are added, and the mixture is then made liquid by heating. The oil combines easily with the other ingredients, and the varnish remains pliable and quite transparent. The expense of a forcing bed arranged in this manner is inconsiderable, and it yields at the same time many other advantages. Such a hot bed needs not the anxious attention required by the ordinary one covered with glazed frames. During the strongest rays of the mid-day sun they do not require any particular covering or shade, the atmosphere therein preserves a nearly equable temperature almost the whole day, and requires only to be changed from time to time, according to circumstances. If such a bed is provided with a soil of horse-dung, and a proper thickness of some fertile, finely sifted heath mould is spread thereon, layers of all sorts of flowers, early vegetables, and other plants, may be reared from seeds in it.

CANDIDUS'S NOTE-BOOK.
FASCICULUS XLIX.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. Many others besides myself have, no doubt, frequently been not a little disappointed, on finding how very poor a building, that has promised tolerably well during its progress, has eventually turned out to be. So long as it was encumbered with scaffolding, and nothing could be made out distinctly, there was room for the imagination to work upon it; but when all is cleared away, then also does the poverty of the design become exposed to view—all faults and defects become apparent, and perhaps you find that when completed, the structure is altogether *unfinished*. Yet "*finish*" is one great secret—and truly a far greater secret than it ought to be, in architectural composition. Nor is "finish" to be confounded with decoration, for there may be the first with little of the latter, and a very great deal of the latter, with nothing at all of the first. Without finish, decoration generally looks trumpery and meretricious, and what is intended for simplicity, shows no better than inconsistent parsimony, and therefore shabby meanness. In fact, finish is essential to simplicity; and of this, Grecian architecture might long ago have convinced us, had we studied it in an artist-like spirit, instead of merely consulting its orders as so many patterns of columns. One rule worth a hundred of those usually given in architectural books, is, never attempt a higher degree of decoration than you can finish up to in every respect; since otherwise, do as much as you will, the ensemble will always be unsatisfactory. There may be both tasteful ideas and beautiful parts—but they will be only parts, causing by their very beauty all the rest to displease. Attention to what seem trifling matters, is a most important matter itself in architectural design, for it frequently constitutes the chief difference between what is excellent and what is poor—between what is captivating and what is dull commonplace. Yet because it happens to be what people call "*Only that*," little regard is paid to it, although the *only* of it, renders the neglect of it all the less excusable. Oh! if we had but all the "only thats" which people give us to understand they could easily accomplish, did they but think it worth while to attend to such trifles, how very superior we should become in art!

II. Of opportunities in architecture there are two sorts—the most obvious and intelligible one, that of having a building to execute which affords some scope for design or the display of taste—the other, that of being not only permitted but encouraged to treat the subject *con amore*, and to satisfy oneself. To talk of an architect's being left to satisfy himself—though some, by-the-bye, seem to be very easily satisfied with themselves—may sound strangely to those who look upon him as little better than a tradesman—not as a professional adviser in art, but a sort of apothecary, who has merely to make up their own prescriptions; nevertheless, it is so essential an architect should have such liberty granted to him, that he who shows himself indifferent to it, almost forfeits the name of artist, showing himself to be little better than a mere hireling. Of course, this is to be understood *grano salis*, according to the circumstances and importance of the case; neither is it to be supposed that employers and their wishes are to stand for nothing in the matter, as if it were of very little moment, whether they were satisfied or not. Let employers explain their ideas, and urge their own particular views, but let them also listen patiently to those of the artist himself, otherwise they show either that they more than doubt his capacity, or that they shrink from listening to arguments that may convict them of ignorance or of obstinacy. Architects themselves, on the other hand, might sometimes profit by the hints and remarks of their employers, and should feel rather inspirited—certainly not discouraged, when they find their designs strictly scrutinized, instead of all their merits being detected at a glance; in which latter case it may be presumed the merits are rather superficial and not very numerous. Excellently well it is observed by Chateauneuf, "undoubtedly it is very pleasant to an architect to meet with an employer disposed to give him *carte-blanche* and permission to follow out his own ideas unrestrictedly; yet it is still more delightful to meet with one, who instead of merely passively acquiescing, assents from conviction, after deliberate study of the ideas submitted to him, and from the lively interest he takes in them."

III. Whatever the *Pa[illegible]ffs* may think of the matter, certain it is, that though the more obvious features of a style may be copied mechanically by any one, to give the true and the better spirit of the style itself requires an earnest study of it, and a kind of study which instead of being to be got out of books, must be brought to them. That such should be the case is rather consolatory than otherwise, since it proves architecture to have some pretensions to rank as a fine art, not only in regard to the works it produces, but to the mode in which it works. In architecture, very much depends upon conventional forms, and conventional as well as mechanical rules; yet though indispensable in themselves, rules are of little more than negative value: they instruct us to do just that which they can teach any one else to do equally well—and no more. They bring us up to the point where the many stick fast, and beyond which only the few can pass who possess within themselves that finer instinct called genius or talent. Though such opinion may appear somewhat paradoxical, by no means does it follow that a building or design which exhibits the more direct and standard features of the style it professes to be in, gives us the spirit of the style itself; for instead of doing so it all it may fail to manifest any of its better qualities, any of its latent powers may indicate nothing. Mere correctness and no more, is not much matter for boasting of, the merit attending it, whatever it may be in itself, being but a second-hand one. Much less is it any merit to be correct only in parts—in the commonplace features of the style professed to be followed, while everything else is all but in direct variance with it.

IV. Professor Cockerell has been denounced by Professor Pugin as the man "*not*" paganizes in the universities, but there was another paganizing Professor before Cockerell at work in them—at least at Cambridge—namely Wilkins, the author of that mass of architectural mawkishness, yclept Downing College, as which James Wyatt's design would have been as good. Colleges are not built every day, therefore when an opportunity of the kind does present itself, it should be prized accordingly, and made the most of; yet it is lamentable to perceive how often some of the best opportunities have been converted into mere jobs. King's College in the Strand is such an architectural nullity, that its insignificance in that respect shields it from criticism, no one considering it worth while to animadvert upon or even mention so miserable a piece of design.

V. Much as it is the fashion to talk about style and styles, we generally content ourselves with their mere *[illegible]*, with sadly diluted, sickly watery stuff, that has neither flavour nor body in it. Of such quality is most of our modern Anglo-Grecian, and our recent Early English. The original spirit is so weakened and rendered so "wishy-washy" by the insipidity poured into it, as to be scarcely perceptible. Yet such dilutions of style are palmed upon us as being quite pure and unadulterated, although they are so only inasmuch as no other spirit or flavour of any kind has been infused into the style nominally adopted, the consequence of which is that we get only the purity of pure insipidity.

BAVARIA.—MUNICH.—THE POMPEIAN HOUSE.—We mentioned in our last the project of the King to erect a Pompeian House near his residence of Aschaffenburg. This plan advances towards realization, the director of buildings, Von Gartner, is instructed to employ the drawings brought by Professor Zahn from Pompeii in 1839, for its construction. It was in this house that the beautiful painting on the walls was found representing Achilles found by Ulysses among the daughters of Lycomedes, also the groups of fauns and bacchantes, on a blue ground, Hippolitus and Phædra, Ceres, Hygeia, Venus, and Adonis. All these will be carefully copied for the Pompeian House at Aschaffenburg, with the rich bronze altars, marbles, and inscriptions found in the house of Castor and Pollux so that the visitor will find himself completely in the *domus* of an ancient Pompeian.

ARCHITECTURAL DRAWINGS, ROYAL ACADEMY.

A change has taken place this season in regard to the Architectural Room, inasmuch as it has been removed to the "opposite side of the way," that is, instead of being on the right, it is now the one on the left hand of the staircase; but as both rooms are of precisely the same size, nothing is gained by the change, in point of increased accommodation, and in other respects matters continue nearly *in statu quo*: for we perceive no improvement whatever in the system of hanging the drawings, of which we have said so much on former occasions, that we are sick of the subject. Neither is there, we are sorry to be obliged to say, any improvement at all in the general character of this part of the exhibition—rather quite the reverse—an obvious falling off; and however it may be regretted, this will hardly be wondered at when we find that a very great proportion of those who have hitherto generally contributed to the attractions of the Architectural Room, have this year sent nothing.

The architects want old Soane among them again, to give them a fillip, for as to the present Professor of Architecture at the Academy, the walls might exhibit a blank, it seems, for aught he cares. There was not a single design or drawing of any kind of his last season, and it is just the same now. We do not say that this is very greatly to be lamented in itself, but it is rather lamentable to find that his example is now contagious. It has been followed by Barry, Basevi, Blore, Burton, Donaldson, Ferrey, Poynter, Salvin, S. Smirke, Tite, Wild, and many others whose names do not immediately occur to us. There is very little to inform us what has lately been done, or what is either actually in progress or about to be commenced. Among other things of the kind we had reckoned with some confidence upon seeing the design for the new Conservative Clubhouse, by Basevi and S. Smirke, nor is that by any means our only or chief disappointment, there being, among many others, the new Chapel Royal at Buckingham Palace, which we are bound to suppose well worth seeing. We should like, too, to have found the design for the façade of the British Museum, which we are told is on the eve of being at length commenced—how we should like the design its! It is a different matter, we suspect, not very much as yet, at all events, Sir Robert Smirke has had ample time for studying it, and improving upon his first idea, nor can he very well fail to be aware that architectural taste has undergone some change for the better within the last twenty or five and twenty years, and that consequently his once admired "classical purity" is not likely to be at all relished—perhaps hardly endured now, but be in very great danger of being voted dull, frigid, and stale common place. Sir Robert Smirke may be quite as able as ever he was—a rather ambiguous compliment, by the bye; but that as it suffice what was talent yesterday, is not always looked upon as such to-day, and he has been standing still and the while, others have not, and even the public have now got ahead of him. Most numerous and ample have been the opportunities afforded him during his career—quite equal, with one exception, to Barry's; but he has frittered them all away, and instead of making, as the latter has done, architectural gems out of small buildings—the Traveller's Clubhouse, for instance—he has made large ones, very little in manner, and exceeding meagre in taste. This, however, is a sort of [illegible], which our readers are at liberty to skip, and we therefore go on to say that, on the other hand, there are [illegible] in the present exhibition that we could very well have dispensed with altogether, they being terribly stale, and withal, most unattractive as drawings. Who cares to look at a frame filled with such nothingness as a parcel of Corinthian columns, merely because they are called "The Temple of Jupiter Olympius"?—or at an architectural [illegible] informing us what was the exact state of the "Erechtheum" last summer? What pretensions, again, have such things as mere architectural portraits—views of buildings in the metropolis, and those tolerably well known—to be admitted into what professes to be an exhibition of original productions, and which, if not strictly confined to them, ought at least to give us only unedited subjects? Exceptions might, perhaps, be allowed in particular cases, where a building that has never been satisfactorily represented before, receives for the first time the attention it merits, and the want of positive novelty in the subject is amply made up for by tastefulness of execution as well as mere fidelity of likeness. This, however, is by no means the case with such things as No. 1187, "Perspective View of St. Pancras Church," or No. 1284, "Interior of St. Martin's in the Fields." If we cannot have what is much fresher and better, far rather would we meet here again with some of the works that have delighted us on former occasions, and to renew acquaintance with which would be refreshening. So impossible is it to discover any sort of system in the management of the architectural part of the Academy's exhibitions, that we fairly conclude there is no system at all, but that the whole is left to "Providence" and the porters. That St. Peter is not one of them, is evident enough, for had he the keys of the architectural room in his keeping, hardly would he admit such architectural Balaam and rubbish as we have seen here hung up, not this season more particularly, but more or less every season. It would seem that any thing in a frame and glass will pass muster so long as room can be found for it, or it serves to fill up an obstinate gap into which no other sized frame can be fitted—which is by no means a very *fitting* practice in itself; at any rate we would rather encounter a few blanks on the walls, than such prizes. It is really grievous to observe some of the *Pecksniff* things that are permitted to show themselves at the Academy, and there stare us full in the face, unless good luck has so well managed both for them and for us, that they happen to be put out of sight. We could mention more than one or even two specimens of the kind in the present exhibition, but the authors of them would hardly thank us for calling attention to them, or feel flattered by coming in for such share of our notice. It is possible that some of the productions of this stamp may be in themselves meritorious, since they may be the works of mere tyros—the first essays of "tender juveniles," who have just learnt to make use of pencil and compasses; but then schoolboy exercises should be kept at home for home admiration, and not publicly paraded, at the risk of being pelted at.

What seems not least of all strange to us is, that there should uniformly be so many things, which professing to be mere designs or ideas, show themselves so barren of ideas—so devoid of any originality either as to conception or treatment. In such cases, it is to be presumed, a design is intended as a display of talent, and to manifest what its author is capable of doing, provided opportunity be afforded him. To produce things of that kind merely to show average taste, and what, if quite as good, is not at all better or more striking than what has been done again and again before, and may be seen almost anywhere, is hardly worth while; nevertheless, we find that it is often done, for be the drawings themselves ever so satisfactory as such, there is very little thinking put into them. Of that description, however, there are very few designs this season—very little in the shape of *Projects*, or what professes to be an relaxed ideal.

Except that it is upon the whole less striking and attractive than usual, it is difficult to say what is the character of the present exhibition, or what class of designs predominate in it. Scarcely ever, indeed, is it possible to form any such general conclusions, or to judge which is the style in particular that seems to be best treated; and this is in no small degree owing to the very great diversity of manner in execution, and the degree of ability displayed in it, for while in some instances things that are rather of mediocre quality in themselves are rendered striking by the taste or spirit with which they are represented, others which are superior as designs, or at least contain superior ideas, are so indifferent as mere drawings as to seem altogether insignificant, more especially when seen along with others, and hastily judged of by the "first sight" impression they make upon the eye. So far, then, an exhibition room is not the very best place of all for forming impartial comparisons, and for judging of the intrinsic architectural merits of the different designs. In order to do that, it would in fact be requisite that they should be all upon the same scale or very nearly so, all in the same style as to drawing and colouring, and moreover, what is not the least important matter, that they should all be to be seen equally distinctly. This last, it must be admitted, is almost an impossibility, since, in order to be so seen, they must all be hung upon the same level, that is, just upon the "*line*," and that line would require to be a very "*long yarn*"—about as long as the front of the National Gallery itself, to accommodate the number of subjects we here meet with. Still some little more judgment, or common sense might be exercised than is done at present; and if the suitable accommodation for them cannot be obtained in proportion to the number of drawings, this last ought to be reduced so as to correspond in some degree, with the accommodation.

Of either Grecian or Roman design there is this year very little, though there is at least one of great merit, and all the more welcome because intended for execution, viz. No. 1290, "Interior of St. George's Hall, Liverpool," J. L. Elmes. It is indeed a most noble specimen of Greco-Roman interior architecture, beautifully imagined in its general composition and arrangement, and tasteful and well

* Speaking of this small but certainly not least work of Barry's, the *Polytechnic Review* says, "A chaste specimen of the Italian style, the more it is examined the more it becomes the subject of admiration, and to some almost of adoration. Barry has had the good fortune to have this monument described by the pen of one of the first architectural critics, by one who is no less qualified for any task by the extent of his knowledge than the soundness of his judgment, and who has perhaps done more by his writings for the promotion of sound architectural principles than most men have by their works."

studied in its details, so as to be perfectly homogeneous in character, and to combine sober grandeur with richness, and with a far more than ordinary degree of picturesqueness and scenic effect also. The design, moreover, engages entirely by its own merits, for though carefully and ably executed, the drawing itself is not at all striking or showy, and has not even the ordinary allurement of colour to attract the eye to it. Not always is it that a public structure which is of imposing architectural character externally, presents a corresponding one within, but in this instance the whole will be of a piece, and not only as regards the degree of effect, but also the species of it. In this Corinthian hall, not only is the style of the exterior kept up in regard to the order and decoration, but also in regard to what is a happy novelty in itself, namely, the closing up the lower part of the intercolumns with ornamental screen walls.

Of Grecian design we have another specimen in Nos. [illegible]2 and 1322, the former being "A south-west view of the mansion now erecting at Silverton Park, Devonshire, for the Earl of Egremont," the other of the "Central hall in it," by J. T. Knowles. The first, being placed over a door, is unfortunately too high to allow us to see more than its general composition, for though the drawing itself is of considerable size, the architectural scale is but moderate. Speaking of the mansion, in the last No. of the *Gardener's Magazine*, Mr. Loudon says, "it is eminently classical, abounding in colonnades and porticos without a single vulgar feature externally;" and that there are colonnades and porticos we can plainly see, but that it is therefore "eminently classical" we will not decide, because we cannot make out the other features very distinctly, nor can we judge at all of the quality of the detail. The interior, Mr. L. informs us, he had not an opportunity of seeing, and so far we have the advantage over him in some degree, being here shown what is, no doubt, the most striking part of the interior, perhaps is made rather more so than it ought to be. This "Hall" is carried up the height of two floors, and on the level of the upper one has a piastyle of Corinthian columns. Taken by itself this arrangement is effective enough, though not particularly novel; but we are of opinion that the general design would have been more classical had the lower order in pilasters been omitted. We do not approve of the introduction of two orders, particularly of two such distinct ones as Doric and Corinthian, in interior composition. To us it generally seems to destroy that degree of unity which we naturally look for in an apartment, and to cause its sides to appear too much like external elevations. We think, too, that in the present instance the Doric pilasters carry with them an air of plainness that contrasts rather harshly with the richly decorated and painted ceiling. The best excuse, perhaps, for the introduction of them is, that they serve to divide the walls on which the upper gallery rests, into compartments, each of which is occupied by a large figure on its pedestal (two of them in all, or five on each side). Though decoration has not been spared, it strikes us that there is a certain poverty of feeling and poverty of form—perhaps owing to the endeavour to obtain simplicity, in some of the separate parts, the door, for instance, would have borne to be made more important and richer in features.

One of the principal subjects in the Grecian style is No. 1197, "Design for an alteration of the National Gallery by effecting, at a small outlay, a more imposing elevation"—D. Mocatta. The "small outlay" is somewhat questionable, nor is the alteration here suggested so satisfactory, upon the whole, as it might have been rendered by the outlay of a little—by which we mean a good deal more study upon it, still we think it would produce a decided improvement with regard to the portico and centre of the facade, bestowing on that part of the composition greater loftiness and also greater importance in other respects, though the dome is removed, but that is a feature that can very well be spared, because while it contributes scarcely at all to give the front any dignity in regard to height, it is in itself as insignificant as it is tasteless. In order to increase the altitude of the portico, the columns are here elevated upon a podium added to the present stylobate, by which means their capitals are raised to the same level as the cornice now is, so that the entablature of the octastyle would clear that of the rest of the front. Thus the centre would be more conspicuously marked in the general outline, and the pitch of the pediment being somewhat increased, and bold acroteria and groups of sculpture being placed above it, the augmentation as to height would be considerable, at least as far as effect is concerned. Besides the embellishment just mentioned, the pediment itself is filled with sculpture; and it would, in our opinion, be a further improvement were some enrichment of the kind bestowed on the podium on which the columns are raised; for while it would give the portico a very unusual and here most appropriate degree of richness, sculpture in that situation would show itself to very great advantage, and would serve to give importance and finish to the plain wall or stylobate below the portico, to which it would become an ornamental crowning frieze. Another very considerable alteration here proposed, as regards the portico, is the covering in the ascent up to it on each side, by carrying the steps behind columns so placed as to form wings or loggias immediately attached to the centre octastyle, but retiring the space of an intercolumn. Thus the whole of the centre, if not exactly the portico itself, would thus be greatly extended in breadth, and be rendered a picturesque piece of *polystylar* composition. So far we are very well satisfied with Mr. Mocatta's suggestions, but in his alterations of the rest of the facade he has been by no means so happy. Instead of being at all improved, the windows are made little better than bare apertures, therefore, instead of contributing at all to beauty, tend rather to impoverish and impair the general effect. Of this design we have spoken somewhat minutely, because it possesses, for ourselves at least, an interest of a peculiar kind, being not merely a work of fancy, but an attempt to correct a rather important public building which is now very unsatisfactory in many respects. What is good in Mr. M.'s project seems worth consideration, we should, therefore, like to see a model of the centre compartment on an enlarged scale.

Besides the subjects we have mentioned, there are scarcely any in the Grecian style, and not very many in the Italian; for Gothic of various kinds, Tudor and Elizabethan, greatly preponderate, and of designs for churches, mansions, almshouses, &c., in those styles we find more than the average complement; and among those for churches are several interiors, one of the most striking of which is No. 1185, "Design for the restoration of the Church of the Holy Trinity, Hull," T. Allom. As may be supposed, the subject loses nothing of its interest by being treated by so able a pencil as that of Mr. A., but it is also an attractive one in itself, and of a character likely to be considered most horribly extravagant by "Church Commissioners." Not knowing what the structure actually is in its present state, we are unable to say what is and what is not the work of restoration, we presume, however, that the fittings-up, pulpit, seats, &c., are entirely so, and they are of a superior kind.

On looking over the catalogue again, and seeing how many names there are of designs for churches, we almost reproach ourselves for negligence in having marked so very few for notice of any kind—either for approbation or the contrary; yet such being the case, it is evident that unless put out of sight, the productions of that class did not strike us as possessing in general more than negative merit—that of being not bad, without being positively good, at least not in regard to any fresh ideas. No. 1247, "Interior of the church about to be erected at Whitstable, Kent," R. C. Carpenter, is of better character than ordinary, plain, but neither impoverished nor tame, on the contrary, marked by considerable vigour of style, and by much pleasing expression. No. 1271, "Design for a church in the Norman style," Gough and Roumieu, shows some fancy, and is represented in the drawing, as a more picturesque composition than usual. No. 1317, "Interior of the Cemetery Chapel erecting at Cambridge," E. B. Lamb, is, though small, a structure, of very superior quality as a design, and is, withal, characteristic of its purpose. Excepting the painted window and the inlaid pavement there is little of actual decoration. Although few, the features are so well marked, so well put together and contrasted, as to give value to each other, and produce a degree of artistic effect, that we could wish to find much more frequently than we do where the means for obtaining it seem to have been far more liberally afforded. This design furnishes an excellent idea for a small private or domestic chapel in the same style.

(To be continued.)

Sinking of the Caspian Sea.—A communication was lately received at the Academy of Sciences from M. Hommaire de Hell on the difference of the level between the Caspian sea and the sea of Azoff. Several scientific men have been charged by the Russian government to ascertain the level between these two seas, but the result has differed so much that a verification was necessary, and this was undertaken by M. Hommaire Dehel in 1838, but it was not until September 1839 that he could establish his points of survey. M. Hommaire Dehel now reports that 18.304 metres is the difference of level between both seas. It results from observations made by M. Hommaire-Dehel on the shores of the three seas of southern Russia, at the mouths of the different rivers and streams in the steppes of Astracan and at the sea of Azoff, that the Caspian sea had formerly a much higher level, and that it was united with the Black sea at a period anterior to any existing historical record. Already this idea as to the junction of the two seas has been maintained but it was said that the Black sea had become lower by forcing its way through the Bosphorus and shedding its waters into the sea of Marmora. The sinking of the Caspian sea has been accounted for by the lowering of the basin, but M. Hommaire-Dehel gives an explanation of this, which he conceives more natural, by observing that the Caspian sea has very few tributaries, and that a diminution in the waters of the Oural and the Volga has been a sufficient cause for the lowering of the level of this sea.

ON THE PERFECT VENTILATION OF LAMP BURNERS.

In consequence of the injury sustained by the books in the library at the Athenæum Club, amounting almost to the entire destruction of the bindings, and the complaints of the members of the vitiated state of the air in the rooms, causing headach, oppressive breathing, and other unpleasant sensations, Professor Faraday's attention as a member of the club was drawn to the subject of ventilating lamp burners in houses, and he was induced to suggest the trial of various plans for affecting the removal of the products of combustion, produced by sources of artificial light. All substances used for the purpose of illumination, may be represented by oil and coal gas; with tallow and wax are also greatly employed, yet as until they are rendered fluid like oil, they cannot be burnt, they may for all practical purposes be classed with it. Now, oil and gas both contain carbon and hydrogen, and it is by the combination of these elements with the oxygen of the air, that the light is evolved. The carbon produces carbonic acid, which is deleterious in its nature, and oppressive in its action in closed apartments, and the hydrogen produces water. A pound of oil contains about 0·12 of a pound of hydrogen, 0·78 of carbon, and 0·1 of oxygen, when burnt it produces 1·06 of water, and 2·85 of carbonic acid, and the oxygen it takes from the atmosphere is equal to that contained in 132 cubic feet of air. A pound of London coal gas contains, on an average, 0·3 of hydrogen, and 0·7 of carbon produces when burnt, 2·7 of water, and 2·5 of carbonic acid gas, consumes 4·26 cubic feet of oxygen equal to the quantity contained in 19·5 cubical feet of air. So a pint of oil, when burnt, produces a pint and a quarter of water, and a pound of gas produces above 2½ pounds of water, the increase of weight being due to the absorption of oxygen from the atmosphere, one part of hydrogen taking eight by weight of oxygen, to form water. A London Argand gas lamp, in a closed shop window, will produce in four hours, two pints and a half of water, to condense or not, upon the glass or the goods, as it may according to other circumstances happen. Also, a pound of oil produces nearly three pounds of carbonic acid, and a pound of gas, two and a half pounds of carbonic acid. Now carbonic acid is a deadly poison, an atmosphere containing even one-tenth of it, is soon fatal to animal life. The various accidents from lime and brick kilns, from brewers' vats, occasionally from the sinking of wells, as at Cheltenham, and from the choke damp in coal mines, attest the extreme danger contingent upon the presence of this substance. A man breathing in an atmosphere containing 7 or 8 parts of carbonic acid, would suffer, not from any deficiency of oxygen, but from the deleterious action of the carbonic acid. M. Leblanc has recently analysed carefully the confined air of inhabited places, and concludes, as stated in his *Memoir*, that the proportion of carbonic acid gas in such places, may be regarded as measuring with sufficient exactness, the insalubrity of the air; that in the proportion of one part to a hundred of air, ventilation is indispensable for the prevention of injury to the health; that the proportion of carbonic acid gas had better not exceed a five-hundredth part, though it may rise without inconvenience, to a two-hundredth part. If a lighted taper be applied to the top of a lamp chimney it will be instantly extinguished, or a glass jar held over it will become immediately filled with air, in which a light cannot burn. Also sulphurous and sulphuric acid, are contained in the water which results from the combustion of coal gas, and are productive of injurious to metals and articles of furniture.

It will now be understood, that the object sought to be attained in the ventilation of lamp burners, is the entire removal of all the noxious products of combustion. And with this view, at Professor Faraday's suggestion, the gas lights of the chandelier in the library at the Athenæum, were ventilated by pipes dipping into the lamp glasses, and conjoining at a short distance upwards into one central pipe, which carried away all the burnt air out of the room. In this first practical experiment, many things were learned as to the mode of arranging the pipes, the disposal, when the pipes were very long, of the water produced, &c., but the objects sought for by the ventilation, were at once and perfectly obtained. This principle may be illustrated by a simple experiment, showing the difference between allowing combustion to give its products to the air of a room, and carrying off these products as soon as formed to the exterior, let a short wax candle be placed burning on a plate, a glass jar put over it, and the upper aperture of the jar closed by a globular cork, through which passes a piece of glass tube, about half an inch in diameter, and twelve or fourteen inches long; the tube descending to the top of the candle flame, and being placed just above it. Under these circumstances there will be plenty of air passing into the jar, between it and the plate, and out by the tube, to supply all that is needed for combustion, and keep the glass chamber sweet; the consequence is, that in this position it will go on burning for any length of time, and the jar remain quite clear and bright, but on moving the cork a little, so that the tube shall no longer be over the flame, all these results will change, though the air way remains exactly as before. The candle will now give the products of its combustion to the general air of the glass chamber, the glass will immediately become dull, from water deposited upon it, the air itself will become worse and worse, the light become dim, and in a few minutes will go out. But if arrested from doing so by the tube being again placed over it, signs of recovering will appear, the light will return to its former brightness, and after a short time, even the dew will disappear from the glass, all in consequence of the proper ventilation of the light. These effects, though striking, may easily be understood by any one who will think of the difference of lighting a fire in the middle of a room, instead of under, or in right juxtaposition to a chimney.

Then came the desire of modifying the system, by removing the ascending flue from its place over the lamp, not from any deficiency in action, but for appearance sake only, and finding that there was sufficient ascension power in the main part of the metal chimney, to allow of a descending draught over the lamp, the tube, in place of going directly upwards, was made to turn short over the edge of the glass, to descend to the area or bracket, to pass along it, and then ascend at the central part of the chandelier, or against the wall if applied to a single light. To this succeeded another form, which is exceedingly beautiful, and appears to be the perfection of lamp ventilation. It is in fact, a beautiful application of the principle of a descending draught to a lamp burner. The gas-light has its glass chimney as usual, but the glass holder is so constructed as to sustain not merely the chimney, but an outer cylinder of glass, larger and taller than the first, the glass holder has an aperture in it, connected

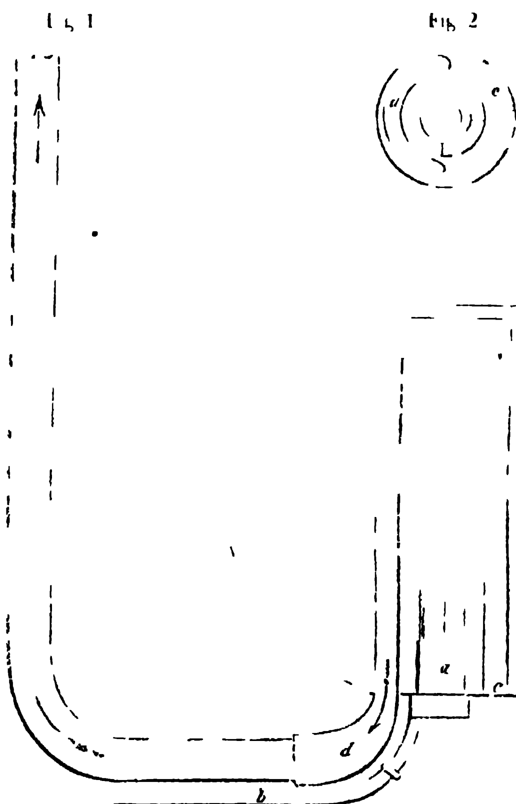


Fig. 1.—*a*, is the burner; *b*, the gas pipe leading to the burner; *c*, the glass holder with an aperture in it opening into the mouth-piece *d*, which is attached to the metal chimney, *i*; *e*, the ordinary glass chimney; *f*, an outer cylinder of glass closed at the top by a plate of mica *g*, or still better, by two plates of mica, one resting on the top of the glass, and the other one *h* dropping a short way into it, they are connected together by a metal screw and nut which also keeps them a little apart from each other, thus forming a stopper which cannot be shaken off the glass chimney, but is easily lifted on and off by the small metal ring or knob at the top; *i*, is the metallic tube chimney; *k*, a ground globe, which may be applied to the lamp and which has no opening except the hole at the bottom, where it rests on the glass holder, but any other form, as a lotus glass or a vase, may be substituted at pleasure.

Fig. 2 is a plan of the glass holder, showing the burner, *a*, in the centre, perforated with jets, with openings round it to allow of a free admission of air to the flame, and the aperture *d*, which opens into the mouth-piece, connected with the metal chimney, *i*.

by a mouth-piece with a metal tube which serves as a ventilating flue, and which after passing horizontally to the centre of the chandelier, there ascends to produce draughts and carry off the burnt air.

The burnt air and results of combustion, take the course indicated by the arrows, and are entirely carried away by the chimney. Now with a lamp burning in the ordinary way, the products of combustion issue out as a torrent of aerial impurity from above, but if the above arrangement be applied, on closing the top of the outer glass cylinder by a plate of mica, all the soot, water, carbonic acid, sulphurous and sulphuric acid, and a portion of the heat, are entirely carried away by the aerial sewerage, and discharged into a chimney or the open air, and the air in rooms may thus be kept in the same sweet and wholesome condition, and fit for the purposes of respiration, as if artificial light were not being used.

A curious but important result of the enclosed lamp, is the increase of light produced, amounting to from 10 to 20 per cent, according to circumstances, the same quantity of gas being consumed as before. If the current of air through a lamp glass, when the gas is burning in the usual manner, be diminished, the flame rises in height, and the light is increased in amount, but is of a redder colour: the combustion in fact is not so intense, because the access of air is retarded: the particles of carbon which give the light, are not so highly ignited, but are more abundant, and are ignited for *a longer time*, thereby causing an increase of light.

The advantages of the above plan are many, it is not in the least objectionable in architectural appearance, the ventilation is perfect, the heat given to a room is modified and pleasant, and may be either sustained or diminished at pleasure: the light, for good philosophical reasons, is increased considerably for a given portion of gas, and increased safety from accidents is obtained, as in the event of any leakage from the pipes, or from a gas cock being inadvertently left open, the gas, instead of mixing with the air of the room, and becoming explosive, would be almost inevitably carried off by the metal tubes.

We understand that Professor Faraday has transferred his right to this invention, to his brother, a gas fitter, who has secured it by a patent.

REVIEWS.

MODEL DRAWING.

A Manual for Teaching Model Drawing from Solid Forms. By BUTLER WILLIAMS, C.E., Director of the Drawing Classes at Exeter Hall, Professor, &c. Under the sanction of the Committee of Council on Education. London: Parker. 1843.

WE have before had frequently to advert to the subject of instruction in design, feeling that we had a double responsibility imposed upon us by our two classes of professional readers: in the first place to advocate the necessity of the proper instruction of workmen, in the next place to watch the interests of art. The want of instructed workmen is a great inconvenience to the professional man, a great obstacle often to the proper execution of his plans, and a knowledge of drawing is essentially requisite in order to enable the mechanic or artizan adequately to execute the designs of his employer. The general progress of art and the creation of a true and sound taste for art, are indissolubly connected with the advancement of architecture and its due appreciation. What is the good of the architect throwing pearls to swine, what stimulus can he have to his exertions from the applause or censure of an ignorant or tasteless mob? The painter, the sculptor, execute their small works for the pleasure of a single individual, or the inspection of a restricted number of visitors, but the architect is called upon to erect monuments which are the delight or disgust of millions. For one man who sees the Loggie or the Sistine chapel, ten see St. Peter's, for one who has the happiness to see Barry's Adelphi pictures, thousands and tens of thousands daily contemplate St. Paul's. The architect, then, has perhaps more at his disposal the means of elevating public taste, than the painter, the sculptor, or even the engraver; it is his to convey those general impressions of art, and that catholic love for it, which the painter and the sculptor are to profit from in their more detailed works. Can we imagine a people living amid the glories of the Parthenon and the other wondrous works of Athenian architecture, without acquiring a deeply rooted sympathy for art—can we suppose men living in sight of the luxuriant monuments of the middle ages, without manifesting a love for beauty of form in every object? We know they did not: we know that the Athenian city, which Pericles built, cultivated every branch of art—we recognize, in the commonest relics of the middle ages, the labours of the artist. When one department of literature is at its height, you have a general proficiency, when one department of art, a stimulus is given to other pursuits. When we had a Shakspeare, then had we Spenser, Jonson, Sidney and Drayton—when Milton, Dryden, Butler, and Denham—when Pope, De Foe, Addison, Swift, and Steele. There is an excitement in a multitude, there is a stimulus in a crowded amphitheatre, which brings out the greatest efforts of the mind, and if you wish literature, if you wish art, if you wish science to flourish, you must not seek to nourish one branch, but to give the greatest scope to all. We therefore cannot pass over in silence anything which so nearly concerns the general interests of art, as the education of the people in design, and the more so at the present period, when an endeavour is at last being made to establish drawing as an indispensable branch of primary instruction.

The work before us is under the authority of the Committee of Council on Education, and published as a text book, which all the schools under their control are to adopt as a normal rule for their guidance. It is drawn up by Professor Butler Williams, C.E., the Director of the Normal Drawing Class, and describes the course followed in them. It would consequently be well worthy of our examination, if it were only to assure ourselves that the artistic instruction of the country would be properly conducted, but it becomes imperative on us to do so, when principles are introduced which appear pregnant with danger to the prosperity and progress of art. With Professor Williams individually, we have on this occasion nothing to do: he seems to have executed the task assigned to him, ably, honestly, and zealously: we shall therefore direct our attention to the system of which he is the expositor.

Among the ancients, drawing was carefully cultivated among workmen, and if we wish to see how extensively and how successfully, we find abundant examples in the unfinished and the complete specimens of the [illegible] vase. Certain it is that the potter of the modern day, is as inferior to his Greek predecessor in artistic proficiency, as perhaps he may be superior in mechanical skill. The use of drawing too was widely spread among the people at large, because among a people uninstructed in writing, delineation becomes both an amusement and a necessity. The Indian thus records memorable events, decorates his war-belt, his weapons and his hut, and amuses himself and his comrades with caricatures on the topics of the day. Thus it must be, even among people more advanced in civilization, while unlettered; and if it were on account of the caricature only, design would be resorted to. The numerous examples of this to be found in ancient history, and in the monuments of the people, show how general was the practice of drawing, and what a strong hold it had among the people. We trace this also in the middle ages, we see grotesque sculptures even in sacred edifices: we find satire lurking often in the [illegible], and we know that commotions were often as much excited by the [illegible] as by the eloquence of a popular orator. Perhaps the general spread of letters no less shook the lower and more popular use of art, than did the Reformation strike merit at its higher efforts. The player, the ballad singer, and the mountebank, strove successfully for the amelioration of rustic art, and the grim visages on the corbels, and the rude chalkings on the wall, lost their wonted charm, and with them much of the love of art and of its practice. Certain it is that in the middle ages, art entered more into the pursuits of life than it did subsequently, and into the labours of every artisan. Clothes, weapons, furniture, were more elaborately decorated than they have since been, or than the simpler habits of modern times will ever allow them to become. It was to this proficiency in the part of the workman, that the mediæval architect was indebted, for the luxuriant finish given to his design, and the rich profusion of ornament that sustained the character of the general conception. How rare, how difficult, has it been in those days, to be able to follow in his steps: the [illegible] of [illegible] is the only means remaining to us to imitate, though humbly, this luxury of the past. The revival of architecture in England made this want to be strongly felt, and the establishment of a school of design by Mr Baptist [illegible], so detailed in our *Journal*, (Vol. V.,) was the consequence. From that time little progress was made until our inferiority to foreign nations and our economic [illegible] so painfully manifest as to induce the establishment of schools of design throughout the country. With regard to the Royal School of Design at Somerset House, it was our duty early to point out the gross and lamentable errors in the system of instruction. We then pointed out the danger of copying from drawings, and the necessity of a greater attention to figure and ornament, if we wished to make the establishment useful to the country or the people capable of competing with their foreign rivals. These views of ours and of those who coincided in them, met with the strongest opposition from the Directors of the School, and from artists, and but little attention from the public. They have,

however, finally prevailed, and the result is that in the general system of elementary instruction in drawing, propounded by Professor Butler Williams on the part of the government, the error of copying from drawings is strongly reprobated, and is excluded from the plan. The Professor says.,

Drawing from Copies.

In the first place we observe, that the pupil is almost universally made to draw from copies.

This fails to exercise the judgment. The drawings which serve as copies exhibit a symmetrical disposition of lines in true perspective, as also varieties of tint and shadow fully laid and harmonized: they are imitated mechanically by the pupil without his understanding or reflecting upon the means whereby certain effects are produced. His hand alone is exercised, he fails to acquire a habit of observing and seeing correctly, and is unable after years of labour spent in these purely mechanical exercises to represent correctly the simplest natural objects. The Chinese cultivate the art of drawing according to this plan; they copy from copies, and produce fac-similes of any work of art, but this is performed solely as a piece of laborious imitation, and their signal failure, when they undertake to design original compositions, is the consequence of the faulty system which aims at training the hand alone to works of the highest skill. High finish in the drawing cannot compensate for glaring inaccuracies of perspective and even the individual form, although elaborately brought out, is devoid of expression, exhibiting labour and pains without intelligence, the consequence of following out detail without comprehending the scope of the whole design, and of exercising the hand without the guidance of science and understanding.

Drawing from Copies a delusive kind of industry.

Sir Joshua Reynolds in his Second Discourse says, "I consider general copying as a delusive kind of industry: the student satisfies himself with the appearance of doing something; he falls into the dangerous habit of imitating without selecting, and labouring without a determinate object; as it requires no effort of the mind, he sleeps over his work: and those powers of invention and disposition, which ought particularly to be called out and put into action lie torpid and lose their energy for want of exercise. How incapable of producing anything of their own those are who have spent most of their time in making finished copies is an observation well known to all those who are conversant with our art."

Moreover the drawings presented to the pupil as models are not always perfect, having themselves probably been copied from other copies which may also have been made without direct reference to nature. The drawings of all are more or less characterized by mannerism, and thus a defect in the original imitation is imitated with care by the pupil.

Exclusive therefore of a certain mechanical facility of touch the pupil acquires little real knowledge by drawing from copies. After years of study he will be capable of making highly finished fac-similes of engravings or drawings, and, if he be endowed with a retentive memory, he will have learned a set of unvarying conventional signs for the representation of natural objects in their numberless variations.

The reprobated, the discarded system of drawing from copies, well represented as "a delusive kind of industry," was that adopted in the school at Somerset House, and tenaciously clung to by the Council. It was by the practice of this mischievous system that our artizans were to be brought up to compete with the better instructed workmen of the Continent, and our proficiency in those arts and manufactures where design is used, was to be ensured. It has been our good fortune, alone among the press, to have assisted in exploding it, and it is, therefore, with the greater feeling of confidence we approach the subject of model drawing, which is, in our opinion, no less erroneous and mischievous, and in which we shall, perhaps, find equal difficulty at first in producing conviction on the part of its advocates, though we doubt not of success in the end.

The common practice of commencing the system of instruction by copying from drawings, received its first grand assault from the eloquent pen of Rousseau, in his *Emile*, who proposed, as a substitute, that the child should commence by drawing the human figure from the life. This was considered too bold, and the well-known educationist, M. Jacotot, modified it, by suggesting the study of figures from the antique. Neither of these systems, however, had justice done to it, and M. La Croix, among others, suggested drawing from models of the simple forms. This has been carried out by M. Dupuis of Paris, under whose auspices it has sprung up into a recognized mode of instruction, and has served as an example for the Committee on Education here. This system proposes for models, the delineation of the square, the triangle, the circle, the simple geometric figures and solids and assumes the merit of greater success, of accuracy and greater simplicity. Now such a system is likely to find converts among those who have prepossessions on the subject, who have not had practical opportunities of appreciating its advantages and defects. It is very well to declaim on this subject, to talk about analysis and synthesis, but the question is of a mental operation and effect, and there, we opine, individual experience and individual imagination can be but of little value. How little by the examination of our own minds have we been able to learn of the mental organization of mankind; how little has the ability and acumen even of a Dugald Stewart been able to effect; and in what a state of uncertainty are the ontological sciences—indeed, what ought to be the highest science is the most unsettled and obscure. This then should teach us the danger of trusting to individual impressions, and induce us to apply to experience, the only proper and trustworthy guide.

Now looking at the matter in every light, we feel ourselves unable to concur with the judgment of those who have adopted the system of model drawing; we are not convinced it is the best, we are not convinced it is the safest. If drawing were like writing, if it were an assemblage of conventional signs, we should be willing to recognise the necessity and utility of an artificial process for its inculcation, but drawing is an art of representation which admits of the least arbitraries, which addresses itself to the representation of nature, and the earliest efforts of which should consequently be directed in the path of future exercise. We cannot understand *a priori*, and the whole of Mr. Butler Williams's reasoning on this subject is *a priori* —we cannot understand *a priori*, why nature is to be abandoned in the study of drawing; it will be granted that the ultimate end of drawing is to copy nature, why should not its novitiate be so directed. We have not heard any valid objections to this obvious course: we have no experience of its impracticability, and we think it at least deserved due attention. Not only then do we believe that drawing from nature is the course in which our efforts should be directed, but we have strong grounds for fearing that model drawing is attended with serious evils. It is well to say that forms in nature are modelled upon the severe outlines of geometrical figures, but such severity is rarely to be met with in the luxuriance of creation. The inculcation then of conventional forms, must be pregnant with danger. What is the mischief of the system of copying from drawings: that it perverts the eye, and renders the pupil incapable of adequately seeing natural objects? The study, however, of natural objects, is a great means of training the eye and the mind. What can we expect must be the result of putting a child through a preliminary course calculated to dull his appreciation and beauty, but to stunt the artistic faculty, and render him less capable of estimating the beauties of nature? That such will not be the result of model drawing has not been proved, and even if the danger be imaginary, care should at least be taken to ascertain that it is so, and not run unprepared into a needless mischief. We, however, say boldly, and we speak from experience, that there is no difficulty at all in teaching a child to draw from natural objects, and no plea satisfactorily proved to us for putting it through an artificial course. We believe, moreover that the mechanical system of the committee of council on education, must tend seriously to the injury of the general taste of the nation, and to the consequent jeopardy of the progress of the higher branches of art. At present the nation is uninstructed in art—it is now going to be perverted—and what hope can there be for the development of taste and genius in the mechanic nation, which it is the effect of this system of model drawing to produce? We say, therefore, that on every ground it is well worthy of consideration whether we are to quit the natural method for one not possessing any adequate advantages to compensate for its striking defects. The training of the eye of the pupil, in the first instance, is everything—that is well known—and all that we want is that it shall not have a false bias. To go the full length of recommending at once the study of the living human figure we do not, but we must say, that if an objection exists to the human figure, on the plea of complexity, there are abundance of simple natural objects of still life, particularly in the vegetable kingdom, affording unobjectionable examples. Why the study of a leaf or of a fruit should be less capable of affording correct instruction to the eye than a circle or a square we cannot understand; and sure we are that more interest would attach to the natural object than to the wire or cardboard model. Indeed, Mr. Williams is obliged to confess to the power which natural objects have on the uncultivated mind, though he qualifies his admission by deprecating the greater love of the lower classes for luxuriance than for simplicity of form. We consider the system of model drawing as unjustified by reason and experience; and we think it was at least the duty of the government, with the ample means at their disposal, to have tried sufficient experiments on the comparative merits of the several systems of instruction in design. The system, now adopted, we are strongly of opinion, will turn out like that at the School of Design, productive of great mischief, and characterised as a serious blunder, happy if, as in the case of the School of Design, it be remedied in time.

On Mr. William's book we could have said a good deal, but we

have thought it our duty at this length to enter our protest against the mischiefs likely to result from the adoption of the system he propounds, and to which we hope the attention of all who desire the sound progress of art, and the proper education of their countrymen will be directed. In parting, we beg to have it understood that our objection does not extend to the proper application of the system of model drawing, but only to its adoption as the means of teaching design in the first instance. We think that at a subsequent period, as a simple means of teaching practical geometry and the elements of perspective, that it is calculated to be highly useful; but it is to the preliminary use we object, as calculated to blunt the mind, instead of to strengthen it, and with such feeling we call the earnest attention of our readers to it.

Now that we possess the advantage of two competent commissions on national art, namely—the Commissioners of Fine Arts, and the Council of the School of Design, we think it is incumbent on the government to obtain their opinion, before further progress is made with the new system.

Arts, Antiquities and Chronology of Ancient Egypt. By George H. Wathen, Architect. London: Longmans, 1843.

Egypt is a theme so much wrought upon as a staple for bookmaking, that we have little temptation to take up a new *réchauffé* of the same subject. Relations of discoveries we can read with pleasure, or any masterly attempt to solve the mystery of its ancient history, but Mr. Wathen's book gave little promise from its announcement, and bears little fruit on its perusal. An architect may do much in Egypt for the information of the archeologist and professional man here, and Mr. Wathen, we believe, has ability enough, but instead of giving us any great account of what he saw, the book is a medley formed from the labours of others. First we have a miscellaneous preliminary chapter showing the common relationship of the priests of Memphis, the knights templars, heralds and freemasons, with a considerable portion of the apocryphal MS. purporting to be a conversation between Henry VI. and some freemasons, upon which, as Mr. Wathen has brought it in *à propos* of Egypt, we shall remark that it is a very extraordinary thing that curiosity should have been dormant as to the proceedings of the freemasons from the time of Henry VI. until the end of the 17th century, and that the regal MS. should be brought to light and transmitted for the examination of Locke, in the time of Christopher Wren. *Verbum sat.* The language of this document favours very much the suspicion of forgery, and the legend is so suggestive of doubts, that it would be safest to put it down to the account of some Chatterton of the 17th century, who have never been wanting at any day. That Locke was at all deceived by it is not wonderful, Chatterton and Ireland deceived better antiquaries. The masonic MS. immediately precedes a long article on the chronology of ancient Egypt, in which confusion is worse confounded, and although we have some glimmering that Mr. Wathen is occasionally right in the new views he propounds, he shows himself so illqualified for a guide, that we do not like to trust to his leading. We certainly wish he had left the subject alone. The next section of his book treats of the arts and antiquities of Egypt, and contains full accounts of the principal buildings and monuments, but chiefly derived from other sources. We regret this, as Mr. Wathen shows a power of observation, which might have been usefully employed in preparing a book of his own. This section contains, in defiance of order, a kind of journal of Mr. Wathen's tour in Egypt, which presents many points of interest, and is the only part of the book which he ought to have published. If we thought it worth while to exercise ourselves upon our author's antiquarian dissertations, we could do so to the satisfactory disproof of many of his positions, though not perhaps much to the gratification of our readers. As a specimen how little light the author is qualified to shed upon Egyptian lore, we refer to pages 56 and 176, 226 and 230 of his book. While, however, we thus object to his having put into his book what he could better have supplied with the results of his own observations, we are bound to admit that for those who desire information on Egypt in a compendious form, and particularly as relates to its architecture, a better book than Mr. Wathen's can scarcely be chosen. We extract from his pages the account of Karnak.

Next to the Pyramids the most wonderful relic of Egyptian art is undoubtedly the great Hall of the temple-palace of Karnak. From the inscriptions we learn that it was founded by Menepthah-Osiri I., father of the great Ramses, who was on the throne about the middle of the 15th century B. C. Its superficial area, 341 feet by 164, is sufficiently spacious for a large quadrangle. Majestic in ruin, what must it have been perfect! The massive stone roof is supported by a phalanx of 134 giant columns, ranged in 16 rows. Most of these are 9 feet in diameter and nearly 43 feet high; but those of the central avenue are not less than 11 ft. 6 in. in diameter and 72 ft. high; the diameter of their capitals at their widest spread is 22 ft. The walls, columns, architraves, ceilings—every surface exposed to the eye is overspread with intaglio sculptures—gods, heroes, and hieroglyphics, painted in once vivid colours. It is easy to detail the dimensions of this building, but no description can convey an idea of its sublime effect. What massive grandeur in its vistas of enormous columns! What scenic effects in the gradations of the chiaroscuro and the gleamings of accidental lights athwart the aisles! As you move on, new combinations unfold themselves every moment. Wherever the eye wanders it is filled with picture—rank behind rank, vista beyond vista. Here your eye runs along a pillared avenue and rests upon a vast column at the end, torn from its basis and thrown against the next—now it "is led a wanton chase" through a labyrinth of columns, which from another point fall into regular succession.

The roof is formed of ponderous blocks stretching across the aisles. The three central avenues rise above the general level like the nave of a Gothic cathedral, and the spaces between the upper piers are filled with close-set loopholes. Besides these, the only openings for light appear to have been the great doorways at the ends of the middle avenue and a few slits in the roof of the remote aisles. Thus while a solemn gloom reigned through the interior generally—so grateful to the eye in this land of glare and glitter—the nave was strongly lighted and brought into prominence as a master line bisecting the hall; and a fine gradation of shade, passing off thence into the obscurity of the distant aisles, heightened the effect of the perspectives.

All the resources of Egyptian architecture are here displayed in perfection; —its enormous masses, its long, close files of columns, its deep seclusions, and its rich pervading sculptural decoration. Burke could not have wished for a happier illustration of that part of his theory which refers the sublime in architecture to *succession* and *massiveness*.

The demolition of some of these masses excites even more wonder than their erection. Solid pylons of enormous bulk are broken up or riven in twain. Vast *built* columns seem to have been dragged from their foundations *en masse*. Architraves many tons in weight, wrenched from their place, now impend over the aisles, suspended by yet heavier masses which have perhaps been thus nicely poising them for ages. One might believe they were giants in those days,

"Giants of mighty bone and bold emprise!"

But the Hall of Columns was but a part of this wonderful fabric. Immense pylons, half buried quadrangles and halls, granite obelisks, and tremendous piles of fallen masonry once formed a range of buildings upwards of 1200 feet in length. The chief entrance was through the gateway of the west front, 63 feet high. Besides these there were other isolated and subordinate buildings. The whole appear to have been separated from the din of the city by an outer peribolus of unburnt brick, inclosing an area about 580 yards in length. A succession of four great propyla led across this area to the side of the chief structure. The outermost, as it was exposed to the view of the city and first received the advancing procession, was the most magnificent. Its length or base line is about 225 feet, its solid width 40 feet; the central gateway is of the granite of Syene. * *

An avenue of colossal sphinxes appears to have been continued from Luqsor up to the outer precinct of Karnak. The few that now remain are mutilated and half interred: but how imposing the effect of such a vista extending nearly a mile and a half over the plain terminated by the great façade of Luqsor! How exactly adapted for the pageantry of processions!

The illustrations, often from the drawings of the author, are of much interest, and we cannot but regret that he has not used his pencil more than his pen.

On the Laying out, Planting, and Managing of Cemeteries, with fifty Engravings. By J. C. Loudon. London: Longmans, 1843.

The establishment of Cemeteries throughout the country, must be gratifying to all who take an interest in public decency and public health, while they possess the extrinsic advantage of affording greater scope to art, and contributing to the healthful exercise of the people. The churchyard is an opprobrium in a civilised community, neither harmonizing with the respect due to the dead, or to the care requisite for the living, and the appropriation of eligible places of interment, is a great step towards a better system. Few of our large towns are now without their cemetery, or city of the dead, and the metropolis has the advantage of being girt with many picturesque and interesting establishments of this kind. Starting from Earl's Court, the circle is continued by Kensal Green, Highgate, Abney Park, the Tower Hamlets, Nunhead, and Norwood, each possessing its peculiar beauties and forming an embellishment to the metropolis, of which several of them enjoy views not to be equalled in the world for grandeur or interest. What more fitting abode for the dead, than looking down on the wide-spreading city in which their lives were passed; hovering, as it were, over the scene in which their loved descendants move, and

awaiting their presence. How much better is this than the Hades of an Egyptian tomb! With the extension of cemetries, attention has been called to the principles on which they are to be founded, and it has fortunately induced Mr Loudon to take up the subject. Those who know his accuracy, his minuteness, and his completeness, will be prepared to acknowledge the merit of the present work, which, without wandering into idle and useless details, treats the subject comprehensively, so as to afford every information which is essentially requisite with regard to it. While attending to the professional usefulness of his work, Mr. Loudon, with his usual good feeling, has not failed to call attention to the necessity of any improvements in the mode of interment. He urges most strongly the necessity of no corpse being interred with less than six feet of earth over it, and supports it on every ground of propriety and necessity. He suggests also several improvements as to the mode of laying out cemetries, and remodelling churchyards, and in fine, the reader will peruse his work with interest and instruction.

Ancient Irish Pavement Tiles, with Introductory Remarks. By Thomas Oldham, A.B., F.G.S. Dublin: Robertson.

This work is of the same value with regard to Irish examples of encaustic tiles, as Mr. Bowyer Nichols' is as to those of England, and shows a laudable desire on the part of the sister country, to draw profit from her antiquarian relics.

The Irish specimens of tile are of three distinct kinds. First impressed tiles, second, encaustic tiles, and third, tiles in relief. Of the first class, Mr Oldham states, that the Irish specimens are principally of the ordinary red coloured clay, the surface being coated with an opaque varnish or glaze, generally of a greenish yellow colour, but occasionally of a dark purplish black, and extending equally over the indented pattern. Although similar examples have been found occasionally in England, in which the hollows were filled with a different substance, removed by washing, our author observes, that he has seen no such case in Ireland, and thinks it exceedingly improbable that such ever was the case in Irish tiles. In the encaustic variety, the surface is quite smooth and flat, the pattern being produced by a differently coloured substance inlaid. The colours are generally bright red and yellow, or purplish black and pearl grey, and sometimes of purplish black and deep red. The third variety has the pattern formed in low relief. To this latter variety Mr. Oldham assigns the later date, considering it referable to the Tudor times, some of the other examples are however as old as the middle of the twelfth century.

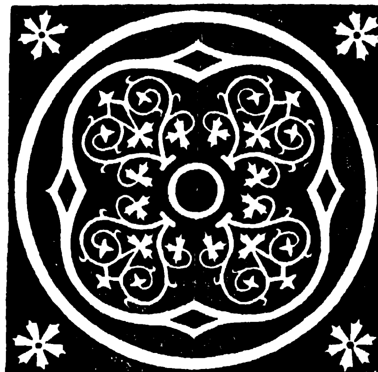
Mr. Oldham mentions some curious facts with regard to the Irish tiles. He says, the identity with English specimens is often recognizable. Thus several of the patterns now remaining at St Patrick's, Dublin, are nearly identical with some from Malvern, in Worcestershire, and it is of additional interest to find, that about the probable date of these tiles, a connection existed between the two places, for in 12[illegible], the year in which St Patrick's was made a cathedral, the prior and brethren of Malvern the Less, re granted to it one half of the tithes of Castleknock, which had been given them in 12[illegible]. A

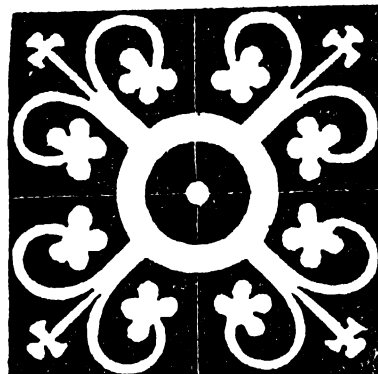


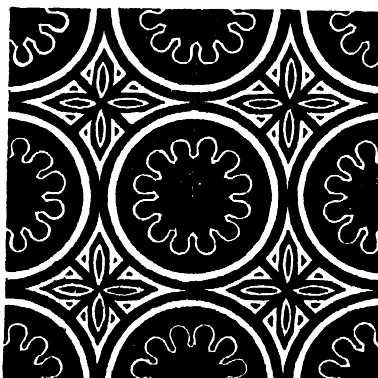
kiln, it appears, has been discovered at Malvern, with portions of tiles in the several stages of the progress, and the tiles there used were manufactured on the spot; whence Mr. Oldham conjectures, that some of the Irish tiles were also derived from the same source. The water communication by the Severn and Bristol with Ireland, would favour this idea. Notwithstanding occasional importations, our author is however of opinion that the majority of the Irish tiles were made on the spot.

The following anecdote with regard to the early use of ornamental tiles, is entertaining. The author says:—

But if, on the other hand, our supposition that the pavement tiles at Mellifont were laid down at the time of its erection, (1142—1157) by monks from Normandy, be correct, it would then appear more probable, that the first knowledge of these tiles was derived from thence, and bearing in mind that Mellifont and Bective were both Cistertian establishments, the following notice obligingly communicated to us by the Rev Richard Butler, is extremely interesting. In Martini's Thesaurus Anecdotorum, among the "Select statutes of a general chapter of the Cistertian order" is one—"Anno 1210. Let the Abbot of Beaubec (in Normandy) who has for a *long time* allowed his monk to construct, for persons who do not belong to the order, pavements, which exhibit levity and curiosity, be in slight penance for three days, the last of them on bread and water, and let the monk be recalled before the feast of All Saints, and never again be lent, excepting to persons of our order with whom, let him not presume to construct pavements which do not extend the dignity of the order. These pavements must have been







either mosaics, (tesselated pavements) or tiles; probably, from the manner in which they are described, the latter. In either case, it proves that ornamental pavements had been a long time in use prior to the beginning of the thirteenth century. Nor should the fact be overlooked of the jealousy with which the use of them was sought to be confined to this monastic order.

Of some of the tiles, by the kindness of the author, we are able to give specimens, and we beg to observe, that the work is a valuable contribution to our knowledge of that branch of art.

The Student's Guide to the Practice of Measuring and Valuing Artificer's Work. By a late Eminent Surveyor. London: John Weale, 1843.

To the student this will be found a very useful guide, as far as it goes, but it is not sufficiently extended to be of that benefit the title led us to expect. It does not explain in what manner the student is to set about measuring or estimating a building, in commencing and proceeding from the foundation to the top in brickwork, and from the roof downwards to the lowest floor in carpentry, or the method of proceeding on each floor in the joining, first with the floor, then the skirting, windows, doors, &c., nor in the plasterer's work commencing with the ceiling, then the cornice, partitions and walls. We have just given this slight and hurried sketch to show that there is a system adopted by all surveyors of any practice in measuring a building, and without such a system, the tyro will get himself into a labyrinth of difficulties, and probably omit some important part of the works. We may probably at a future opportunity be induced to give some instructions on measuring, for we have often seen attempts to lay down rules for that purpose, but none of them appear to us to be of that satisfactory character which we think suitable to the student—however, the work now before us, for the present we recommend, as we consider it the best that has hitherto been published, and will render some assistance in valuing and making out builders work, and give some insight into the abbreviations, method of entering the measurement, the abstract and drawing out the bill of quantities.

A Course of Practical Geometry for Mechanics, by W. Pease.—This book contains the principles of Geometry, which the author has condensed very satisfactorily into a small space, so as to render the work both cheap and useful to the student.

The Guide to Hayling Island near Havant, Hants.—To the visitors of this watering place this guide will be useful.

PROPOSED EXTENSIVE IMPROVEMENTS IN THE CITY OF LONDON.

At the last Court of Common Council, the Special Committee appointed to report upon the proposed improvements in the city, presented their report, which not only contains numerous suggestions, but we fear it will be several years before they can be carried into effect, they observe that

It has long been the subject of public complaint that Newgate street, Snowhill, and Holborn, the great thoroughfare to the north-western, and that of St. Paul's Churchyard, Ludgate hill and Fleet street to the western part of the metropolis are both quite inadequate to the immense traffic of carriages, waggons, and vehicles of every description which throng in those directions, and the numbers of waggons and carts which convey provisions to and from Newgate market frequently choke that thoroughfare, creating delays and inconvenience to the mail coaches, and other impediments to the post office arrangements. The special committee having examined carefully those plans which have been suggested to the Commissioners of Woods and Forests for a new thoroughfare commencing in the neighbourhood of Leicester square, through Lincoln's inn fields into the city, crossing Farringdon street by a viaduct, next considered the practicability of forming a street which would connect the end of Cheapside with such a thoroughfare at Lincoln's inn, and with a branch diverging into Holborn, which would effectually relieve the great pressure of the public traffic in the thoroughfares alluded to, and at the same time render a viaduct at Holborn-bridge unnecessary. They were of opinion that the formation of a street combining these desirable objects was decidedly practicable, the street to commence at the east end, and continue along Paternoster row, through Amen corner, across Farringdon street to the south west corner of Farringdon market in a straight line, the main line to continue across the middle of Fetter lane to the city boundary, and a branch to diverge from the corner of the market to the end of Fetter-lane, at the summit of the hill in the wide part of Holborn. The special committee having had the levels in this proposed new line accurately taken, find that the greatest inclination of any part of it would not be more than about 3 feet in 100, and that only for the distance of 370 feet. It occurred to them in pursuing the investigation, that this new line would be still greater improved by the removal of the whole of the houses between the north side of St. Paul's Churchyard and Paternoster-row, from the end of Cheapside as far as Ave Maria-lane, which could be done for the additional sum of £150,000. Should this be effected, that magnificent structure would terminate a vista of upwards of one-third of a mile, and the whole would, in addition to the increased facility and convenience which would be afforded to the growing commercial traffic of the city, form one of the grandest improvements of an architectural character, yet achieved in the metropolis.

The order in which the special committee have classed the improvements which they consider called for, is according to the relative importance of each, and as follows:—

A. From the east end of Paternoster row to Fetter-lane, and a branch street to Holborn, commencing with the houses at the west end of Cheapside, projecting beyond the line of St. Martin's le Grand, all between Paternoster-row, St. Paul's Churchyard, as far as Ave Maria lane, Amen Corner, crossing the Old Bailey, to Farringdon street, to Shoe lane, Printer-street, Great New street, to Fetter lane to the city boundary, and the branch street from Little New street, to the north end of Fetter-lane, Holborn, about 3360 feet in length. The greatest acclivity in the whole of this line will not be more than 1 in 31, and that for only about 370 feet.

B. From the north end of Dowgate hill to the east end of St. Paul's Churchyard, thence to Earl street, Blackfriars, through Lower Royal, Little and Great Distaff lane, crossing the Old Change into St. Paul's Churchyard, about 1360 feet in length, and from the Old Change, through Knight-rider-court, Carter lane, Godliman street, Bell yard, Addle hill, to the east end of Earl street, about 1200 feet in length.

C. Watling street, from Aldermary Church to the west end of St. Paul's Churchyard, about 1055 feet in length.

D. The Poultry, on the north side, to the Old Jewry, and 100 feet of the north side of Mansion house street, about 1055 feet in length, from the Mansion house across Bucklersbury and Size lane to Queen street, from Watling street to the east end of Basing lane, the east side of Queen-street from Watling street to Thames street, about 1400 feet in length.

E. Lime street, east side, from Cullum street to Fenchurch-street, Leadenhall market, from Fenchurch street through to the south end of Gracechurch street, about 800 feet in length. Aldgate, south side, from the Saracen's Head to Jewry street, and the east end of Leadenhall street at its junction with Fenchurch street.

F. Bond street, Finsbury, to the Curtain road, through Halfmoon street to Sun street, thence to Skinner street, and on to Worship street, about 1550 feet in length.

G. From Aldersgate street, opposite the end of Jewin-street to Smithfield, and from the corner of Little Britain across Bartholomew close, to communicate with the above line of street to Smithfield, about 1280 feet in length.

H. Threadneedle street, north side, at its junction with Broad street, and south side, from the church of St. Bennet Fink, to Finch lane, about 265 feet in length.

I. Holborn bridge, north side, about 90 feet in length. Butcherhall lane, east side, about [illegible] feet in length. St. Martin's le Grand, north east corner, Angel street.

K. Maiden lane, north and south sides, about 275 feet in length. Jewin-street, south side, from the corner, Redcross street to Redcross-square, and north corner, next Aldersgate street. Aldermanbury, the west side of the south end. Milk street, east side, next Cheapside. White Rose court, Coleman street and Mason's alley, Moor-lane, south side, east corner, and north end, west side, from White street to Type street, and south end Milton street, east side, New Bridge street, Blackfriars, through Tudor-street to the Temple.

Having thus detailed these improvements, the special committee turned their attention to that part of the reference whereby we were directed to report our opinion as to the best means of accomplishing these objects, and having had under consideration the various improvements which have been carried out during the last 12 years, as connected with the avenues and approaches to London-bridge, ascertained that our expenditure in this respect has averaged about £150,000 per annum, a sum which they apprehended, if the same could be provided for a few years, would enable all the proposed improvements to be carried into effect, and feeling that the corporation have not the means at their disposal of effecting these improvements, however desirable the same may appear to be, the special committee were of opinion, as Her Majesty has been graciously pleased to appoint a special commission for the purpose of considering of further metropolitan improvements, which commission is now sitting, that a favourable opportunity exists for drawing the attention of the Government and the commission as to the best means to be adopted for raising the requisite funds for these purposes, and recommended that we should be empowered to confer with them upon this desirable object, and we agreeing with the special committee in the said report submit the same to the hon. court."

The report was signed by 21 members.

THE TWEEDDALE PATENT DRAIN TILE AND BRICK MACHINE.

Fig. 1. Tile Machine.

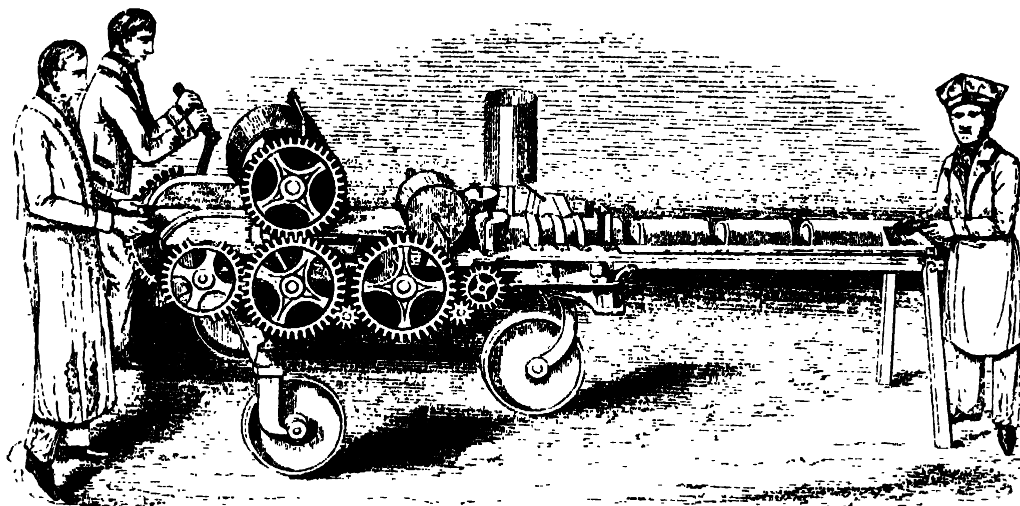
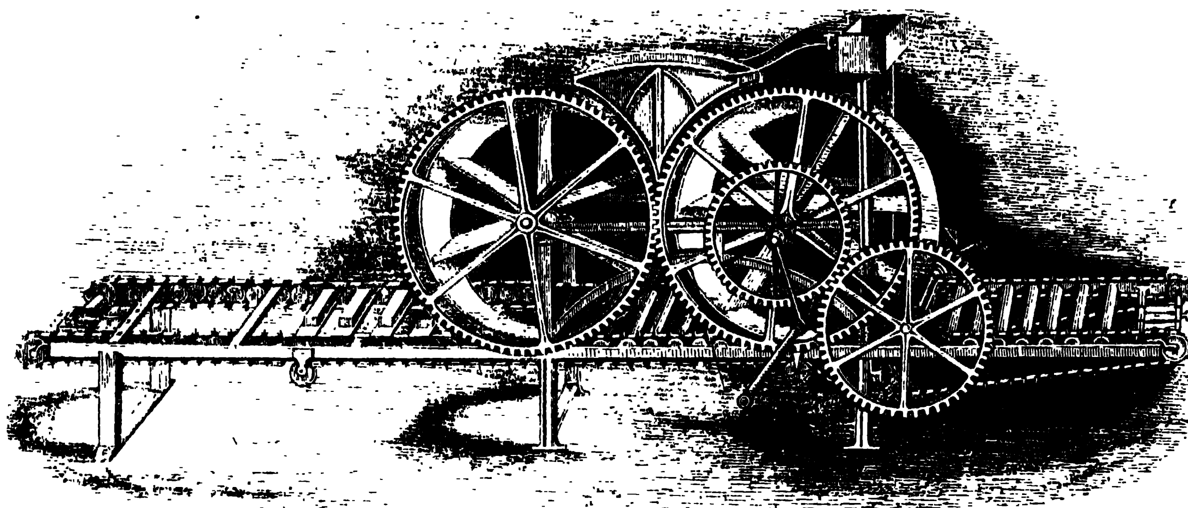


Fig. 2. Brick Machine.



These machines, the invention of the Marquis of Tweeddale, have recently undergone very considerable improvements, and are now made to be worked by manual power, and are so portable that they may be removed and placed in any part of the tile sheds or brick fields. Formerly the machines were worked only by steam power, which in many cases was found to be highly inconvenient and expensive, as it was necessary to have the machines fixed and the clay brought to them sometimes at a considerable distance. The new machines, exhibited in the above engravings, can be worked by one labourer independently of the filler and attendants to remove the bricks as they are made.

The machines act with great simplicity, yet with the utmost accuracy. The one used for tile making, Fig. 1, consists mainly of two iron cylinders, over which webs or bands of moleskin, or other suitable cloth, are made to pass. By this arrangement the clay is pressed into a web of uniform thickness, without adhering to the cylinders. It is then carried over a covered wheel, slightly curved on the rim, and begins to assume the bent shape of a draining tile; a tendency which is increased by several inexpensive but effectual contrivances; and the tiles are polished and finished by passing through three graduated iron moulds of horse-shoe form, as seen in the centre of the machine, being at the same time moistened from a cistern on the top of the machine. The tiles are then cut off, with mathematical accuracy, to such length as may be required (fifteen inches being generally recommended as the most profitable and convenient), and then they are conveyed to any re- distance by an endless web, and from thence are placed by two lads drying shelves. Flat tiles, or soles, are formed in precisely the manner; except that they are partially divided into two portions while ing through the moulds, the quantity of clay required for one draining being the same as for two soles. The tile machine will make from 10 to 15 bricks per minute.

The brick machine, Fig. 2, is on the same principle, but varied to suit the different character of the article required. The clay is placed in a receiver or "hopper" above the two cylinders; and it descends between them into a mould or box, in such a way as to become perfectly formed and pressed into the shape of a brick in the transit. By a recent skilful improvement, a series of palate-boards is borne along by an endless iron chain; and the adjustment is so correct that at the exact moment of passing under the mould, each board is lifted to receive the new formed brick as it is emitted from the mould, and separated from the main body of clay; the palate board then drops again into its place with the brick, and is conveyed horizontally along the web just mentioned; hence it is removed on to barrows by the barrowmen.

It is not the least of the merits of both machines that, although acting with the accuracy of clockwork, they are not liable to derangement; and that, while they are suitable for the application of steam or other power when very large quantities are required, yet they are so simplified as to be also within the management of a couple of common labourers, with the assistance of two or three boys to remove tiles, or the like number of men in the case of bricks.

The quantity of articles produced is not limited by the machines, as they will manufacture any number that can be conveniently taken away. The general range is from 15 to 20 bricks or tiles per minute, when hand labour is employed to work the machines.

Several of these machines are now in operation in different parts of the United Kingdom, and on the Continent. The principal portion of the bricks for the rebuilding of that portion of Hamburgh destroyed by fire, are, we are informed, made by these machines. One of the machines may be seen at the Company's wharf, Millbank, Westminster, near Vauxhall Bridge.

THE XANTHIAN MARBLES IN THE BRITISH MUSEUM.

Amongst the valuable, though to the public taste not the most attractive, additions to the contents of the British Museum, are the marbles brought from Lycia, and which have been placed temporarily in the two rooms leading to the Elgin marbles. These treasures not being as yet entered in the synopsis, or presenting to an ordinary observer no striking or remarkable feature, have not yet attracted that notice which their importance demands. Still they have not been altogether unnoticed by the crowds of holyday folk who have thronged to the Museum during the last few days, and who seem unanimously to regard them as "very ancient" and "very curious."

These marbles, which were discovered by Mr. Fellowes, while travelling in Asia Minor, in 1838, are said to be the most remarkable and important accession received by any European museum for many years, and have been obtained and brought to England in consequence of the greatest enterprise and self-denial on the part of the gentleman by whom they were discovered, and in consequence of whose representations respecting them they have been lodged in the British Museum. The marbles already secured to the British nation are but a small portion of those that abound in the interesting country from which they have been brought; they are, however, very valuable, and some idea of their quantity may be obtained when we mention that they were brought to England in 78 large and heavy packages.

The Xanthian, or Fellowes marbles, as it has been proposed to have them called, illustrate the mythology, the modes of warfare, and a variety of interesting features in the manners and customs of the ancient inhabitants of Asia Minor, who were originally settlers from Crete.

As might be expected, these sculptures do not, as works of art, rank with the Elgin marbles, but they are highly interesting as illustrating the state of sculpture in a much earlier age. They are supposed to include some of the earliest efforts of Greek art which have come down to our times.

The principal objects in the collection are those which Mr. Fellowes describes as the *bas-reliefs* representing the legend of the daughters of King Pandarus being carried away by the harpies, which were around the high square monument, which was called the harpy tomb. The marbles belonging to this tomb are placed in the centre of the grand central saloon, arranged as they were before being taken down. Near them is placed a model of the tomb, which was supported by a shaft 17 feet high, and weighing 80 tons, standing on a plinth 6 feet high. The tomb itself was 3 feet 3 inches in height, surmounted by a cover which weighed from 15 to 20 tons. The central saloon also contains some very beautiful frieze work, representing in *bas-relief* a bear hunt: all the figures, the horses and horsemen, the dogs, and the unfortunate bear itself, are very spirited and bold, but not highly finished specimens of art. Some of the figures on the harpy tomb, and those placed on the under ledge of the same large framework, bear a considerable resemblance to the figures on the monuments of Egypt; we may mention particularly the gods seated on chairs, one smelling a lily, and another giving a helmet to a warrior. In the anti-room there are several very rich friezes. One represents a sacrifice; the fire is burning on the altar, and a number of persons are approaching with various offerings, both animal and vegetable, and in cases the offering may be readily distinguished. The siege of the walled town forms in itself an interesting subject; the walls are defended by warriors armed with stones, which are also the weapons in general use among all the combatants; on the walls are a number of females, whose countenances indicate great distress, as they well may, for the artist has introduced an escalade, which is sufficiently indicative of the danger of the inhabitants. The friezes and the pediments in this room contain some figures, which for vigour of design, if not for beauty of execution, may vie with the Elgin marbles. Mr. Fellowes, in his account of the transmission of these marbles to England, remarks that the frieze so accurately illustrates the description given by Herodotus of the capture of the early city, that he could almost fancy that the neighbouring historian had written his history from it, commemorating an event which happened about a century before his era. We understand that a room is to be prepared expressly to receive this valuable addition to the antique sculptures with which our great national collection is enriched.—*Times.*

DREDGING AND DREDGING-MACHINES.

Sir—As to working a machine a-head by the engine, although, as you remark in your foot note to my communication on this subject, in the last number, it is one of the most obvious applications of the engine power, yet it is not equally so under all circumstances. Where a machine is used to keep a harbour dock or navigation *clean*, the application is most obvious and advantageous, as the traverse of the machine may be quite uniform; but where the natural bottom has to be dredged out, the advantage is not so great. Indeed, in such a case, it is impossible to apply a *constant* power to the bow chain in trench cutting, (or the lateral chains in radius cutting,) else the machine would be broken by natural interruptions, such as stones and roots of trees occurring. But if the engine power be applied to a crab-winch, and the chain be brought with about three turns round the winding barrel, so as to give it just sufficient friction to drag the machine under the ordinary resistance to the buckets, and of course allowing the end of the chain to coil upon the deck, an intermittent motion may be had. If, however, a man attend to this crab-winch while the machine is at work, and on the given signal from the captain, throws a slack of chain on the winding barrel to cause it to slip, and so stop the advancement of the machine, this motion may be rendered quite as manageable as if performed entirely by manual labour. It would, of course, be an object to dispense with the attendance of a man at the crab-winch or with the winch also, and to wind the chain on a barrel at the engine, but then no friction straps or the like could produce such a motion as that given by the man letting the chain slip or lose hold entirely, as required. A fast and loose gearing would scarcely do, but, with friction cones, it would certainly approximate to a hand motion, sufficient for ordinary cutting.

In my communication last month, I did not say what motive power I would apply to the lateral chains therein proposed, but the above remarks apply equally to them as to a bow chain. Where the motion of the machine (*i. e.* the progressive motion of the machine or boat to the stuff) may be uniform, the application of engine power would be an additional saving, as they would only require an occasional inspection, but in the case where the motion must be intermitted, the method of "radius cutting" reduces the labour of winding so much, that if a man attend to the chains he can also wind them. In a small machine, about 50 feet long, one lateral chain on each side may be sufficient.

As the reduction of the number of hands required to work dredging machines must be an object with every engineer whose works require the use of them, in as much as it is creditable to raise the stuff at the least expense which local and other circumstances will permit, many ingenious arrangements might be thought of. In those machines in which the bucket ladder is placed in the centre of the boat, there are levers at hand, by which the captain, while taking the soundings in the well, can raise and lower the ladder. In the same manner, when engine power is applied to the crab winches, rods might be brought from their fast and loose motions, so as all to be at one point. Always adapting the machine to the nature of its work, I am not aware of any works where the machines are divided and adapted to different sorts of work, which has made me keep this point in view in my preceding remarks.

If each machine be adapted both for light and heavy work, there must be a waste of power; but more on this again.

W. C., C. E.

30, *Hope Street, Glasgow*,
26th April, 1843.

Paris.—The monster elephant which has for 30 years guarded the Place de la Bastile in memory of Napoleon's Egyptian exploits, is about to be cast in bronze, for the decoration of a grand fountain to be erected in the Place du Trone. The giant animal is already caged, for the purpose, within a system of boardings forming a vast workshop, and at once exciting and baffling the curiosity of the Parisian street hunters. The papers also state, that the commission for erecting the tomb of the Emperor Napoleon has come to a decision that the baldachin of the altar at the Invalides, with its gilded columns, shall be suppressed; that the equestrian statue of the Emperor shall be erected on the Esplanade, and not in the Cour Royale, as designed by the architect, and that the figure of the Emperor shall be in his historical dress, and not in the Roman costume. The Minister of the Interior has given commissions for twelve statues, to be placed in the niches of the principal façade of the new buildings at the Hôtel de Ville. The following are the subjects — Frochot, Voyer d'Argenson, Etienne Robert, Vincent de Paule, L'Abbe de l'Epee, Robin, Jean Aubry, Hardouin-Mansard, Guillaume Budé, Mathieu Molé, Michel Lallier, and La Vacquerie.

C. W. WILLIAMS' ARGAND FURNACE.

Questions relative to the effect of C. W. Williams' Argand Furnace, as answered by the Commanders and Engineers of the undermentioned Steamers, 28th March, 1843.

Names of Steamers	How long since the apparatus was introduced into use?	Did your furnaces make much smoke before they were altered?	Do they make less smoke since they were altered?	Had you a sufficient supply of steam before the furnaces were altered?	Have you as good or better command of steam since the alteration?	Does the use of the Apparatus effect any saving of fuel, and to what extent?
Hibernia	12 months	A great deal of smoke	Much less smoke, scarcely any to be perceived	Yes — but not too much	Yes—a great deal better and was enabled to blow off copiously	On the average of trips we save at least 3 cwt per hour
Ballinasloe	7 months	Not much smoke	Since the alteration there is less smoke than before	Yes	I should say a better command of steam, though we have new cylinders of larger dimensions	Consumption much about the same as before, notwithstanding about 16 horses power added and an increase of two revolutions
Nottingham	19th April 1841—say two years	Yes—a very thick black smoke	No smoke is now made except when fires are lighted, or coals are being thrown on	No—scarcely enough of steam	We have now an abundant supply of steam.	Consumption of fuel the same as before
Athlone	7 months	A great quantity of smoke was made previously	No smoke is now made after the fires are put in good order — a light smoke when [illegible] firing	Rather insufficient in steam	We have now a very plentiful supply of steam	About four tons of fuel less is now consumed in the trip than before the alteration
Royal Adelaide.	10 months	Yes—we smoked very much	Only when fires are first lighted or with bad coal	No—we had but little except with very good coal — then with great exertion we worked to full power	We are convinced we have, and particularly with good coals	Yes — this is experienced when burning good coals but not when with a bad quality
Royal William.	Nov. 23 1842	Made much smoke with the former boilers	Very little smoke now	The apparatus attached when the present boilers were put in	Sufficient supply of steam	Apparatus always applied to these boilers
Prince	Always to these boilers	Smoked much with former boiler	We have made very little smoke since the commencement with present boilers	Apparatus always attached to present boilers plenty of steam at all times	Apparatus always attached—plenty of steam at all times	Apparatus always attached therefore cannot say
	9 months	A great quantity of dense black smoke	They now make scarcely any smoke after the fires are well lighted	We had sufficient before the alteration	We have quite sufficient as we had before	Without the air pipes we made 16 voyages 371 hrs Coals consumed 571 tons; With the air pipes we made 16 voyages 373 hrs Coals consumed 522 tons Saving 49 tons
	Above 2 years	Long before the wind they smoked considerably at other times not so [illegible]	No smoke except when firing up or making the fires and then only a short time	We always had a good command of steam	We have better command of steam if the coals are good we can make any quantity of steam with the greatest ease	To the best of our judgment about 4 cwt per hour
Birmingham	1 month	At times they smoked	No black smoke now appears while under way but a mixture [illegible] [illegible] for a few seconds after firing	I have always a sufficient supply of steam	At all times a sufficient command, and are now enabled constantly to blow off steam	We save about 1 cwt to 1½ cwt per hour
Isis	9 month	A dense black smoke	Much less smoke	No we had not sufficient steam	Very much better	From the nature of our service I cannot say
[illegible] (from Alexandria)	20 months	Yes—we smoked considerably as much as any vessel of our class	[illegible] is warmed [illegible] we do not smoke [illegible] when firing up or [illegible] and then only a [illegible] time for a few [illegible]	We were always pretty well for steam when using good coals	We consider that we have a much better supply with the air apparatus—there is no question of it	We think we are saving from three to four cwt per hour For many voyages our consumption averaged 26 cwt per hour It was 30 cwt previously
Hindostan (from Calcutta)	Put in on arrival at Southampton	Voyage from Liverpool to Southampton, smoked much, from both funnels	[illegible] now seldom or [illegible] seen	Not over abundant	Sufficient steam now	The air boxes are a great saving, both in fuel and supporting the bridges
Brandon (Glasgow)	4 months	A great quantity of smoke	Smoke nearly done away with, except at firing, and when raising steam from cold water	Sufficient	Much about the same	From 15 to 20 per cent of fuel is saved
Dædalus (Liverpool)	9 months	A great deal of smoke	No smoke now except when the fire is lighted	Not half enough	Much better	Yes, at least one-third

Since the above was printed, the *Queen Victoria* (in Liverpool) and the *Branda* (in Glasgow) have been added to the list, in both of which the apparatus has been successfully applied.

C. W. WILLIAMS' PATENT SMOKELESS ARGAND FURNACE.

SIR—As the application of Mr. C. W. Williams' Argand Furnace to marine boilers has been questioned, we beg to request your giving room to the accompanying tabular view of its adoption on board several steamers, and to add that the apparatus continues to be applied to such boilers as from their construction are susceptible of improvement.

I am, S ,
Your's obediently,
DIC KS & C O.

M a 5, 1843.

P. S. By the returns in the foregoing table it will be seen that the advantages are greater in some vessels than in others. This difference is chiefly attributable to the construction of their boilers. In marine as well as land engine boilers, the arrangement of the flues frequently renders them incapable of improvement such arrangement not only injuring the draught, but tending to obstruct, rather than aid, the natural and chemical process of the combustion of the gaseous matter of the coal. In some of the boilers in the above table, there appears to be a considerable saving of fuel where there had been a sufficiency of steam. In others, the advantage of the apparatus is shown by obtaining a better supply of steam from the same quantity of fuel. In all, the great evil of smoke is avoided. Where furnaces are properly attended to, by having the bars kept *thin* and *well covered* with fuel, smoke will be prevented, and more heat generated. Any deviation from this, by having the fire too long—by improperly feeding the furnaces or allowing the fuel to burn in holes or irregularly—or by heaping the fresh coals in front, and allowing the back part of the bars to be uncovered or without the full supply of fuel, will be attended, either with the generation of *visible* smoke, or the escape of the gases unburnt, though *invisible*, with a loss of heat, and consequently a diminution of steam. It is here to be noted, that the absence of *visible black* smoke is no test of the combustion of the gases. What is called the "combustion of smoke" is not unfrequently the effect of the mismanagement of the fuel, by which its inflammable gases pass away in an *invisible* form. Smoke is the result of the imperfect process of combustion of the gases, and as the process cannot be twice performed in the same furnace, the "combustion of smoke" is hence a chemical absurdity. Dr. Ure, writing to Mr. Williams, says, "I quite agree with you in considering the *prevention of smoke* to be the true mode of curing the nuisance, for when the carbonaceous particles become deposited, it is impossible effectually to burn them, so as to destroy the smoke which they occasion, or rather constitute." Professor Brande says, "As to the quibble about *burning smoke*, it is, in other words, burning what is to be presumed has already been burned, and therefore cannot be burned twice over," &c. "I can see nothing that in the least invalidates your views respecting the *prevention of smoke*, by the combustion of that which would become smoke, *if not so ld et it*."

NOTES ON THE USE OF SUBLIMATE OF MERCURY AND SULPHATE OF ZINC, AS PRESERVATIVES TO DECAY IN TIMBER.

Various attempts have been made by different individuals to render timber indestructible, both as regards fire and the hand of time; also to render timbers of inferior qualities equal in hardness to those of the best description, for the two latter purposes a solution of pyrolignite of iron and chloride of lime have been employed, and for the former, solutions of the sulphates of copper and iron. It has long been known that the saturation of skins of birds and anatomical preparations, in a solution of corrosive sublimate of mercury, tended to their preservation, and it was suggested by Sir H. Davy and also by Mr. Chapman, that the same solution was capable of preserving timber; but it was reserved for Mr. Kyan to bring the subject to bear in practice, who, as long ago as March 1, 1828 submitted some timbers to his new process, and the first examination of which took place in three years afterwards, and the second in July, 1833, five years afterwards. Since then the use of sublimate as a preventive of dry rot and decay has been termed Kyanizing, after Mr. Kyan, who, in 1832, took out letters patent "for a new mode of preserving certain vegetable substances from decay," and in the same year had some specimens of timber, prepared with the solution, tested in the fungus pits of Woolwich dockyard, which stood the trial satisfactorily. In 1835, the paling of Regent's Park, in London, was so prepared, and in the same year Sir Robert Smirke employed Kyanized timber in the erection of the Oxford and Cambridge Club, and Messrs. Grissell and Peto, the builders, erected tanks and purchased the use of the patent, and Mr. Samuel Beazley, the architect, reported, in Jan. 1831, favourably of the paling in the Regent's Park, which had been submitted to the process. The above authorities, I have no doubt, gave the system of Kyanizing an impetus of which it has not yet lost the beneficial effect. Above twenty railway companies used the patent for the preparation of the sleepers of railways, both for cross and continuous bearings, it was used on the viaducts of timber on the North Shields Railway, by Messrs. Green, and also by the Honourable Commission for the repair of the Menai Bridge. The Kyanizing system has been introduced into Holland, where the Commissioners of the Dutch government made a favourable report in May, 1838 and it has also been used for the Austrian railways. A company is now using the patent in England under the title of "The Anti-Dry-Rot Company."

An improvement on mere saturation was suggested and acted upon by Sir William Burnett, in Aug 1836, and being favourably reported on by the Admiralty, a tank was erected at Portsmouth, being of wrought iron, 52 ft. long, and 6 ft. diameter, and another was erected by the Hull & Selby Railroad Company 70 ft long 6 ft. diameter. The Anti-Dry-Rot Company under Kyan's patent has also a 60 ft. tank and hydraulic apparatus, at their works, City Road [illegible]. The timber is piled inside these tanks with interstices, [illegible] exhausted by a pump to a vacuum of 25½ in. of mercury, and [illegible] admitted and submitted to a pressure of 100 lb. by a force pump, by which means the saturated solution is forced into the pores of the wood. Some doubts have been expressed as to whether the proper effect is obtained by this mechanical process, the action being chemical, and time for saturation being required.

The report of the Committee appointed by the Lords of the Admiralty printed by order of the House of Commons, July 9 18[illegible], contains the following observations, founded upon some experiments made at Somerset House. The solution used for preparing the timber, contains 24 lb. of the corrosive sublimate to 1062 gallons of water, or about 1 lb. to 5 gallons, and the cost of the sublimate is 7*d*. per lb., and that the solution diminishes in bulk and not in strength by use.

Professor Faraday delivered a lecture at the Royal Institution on dry rot, in Feb. 1833, Dr. Birkbeck at the Society of Arts, Dec. 9, 1834, and Robert Dickson, Esq., at the Institution of British Architects, April, 1837, and a pamphlet was published by J. C. Adlard on Kyan's process, all approving of the process which shows the prominence this subject has assumed within late years.

The following is the cost of Kyan's process as first promulgated in January 183[illegible] —

	s.
Tim e per load of 50 cubic feet	5
1 lb. of corrosive sublimate to 10 gallons of solution .	5
Labour for 1 load of timber filling and emptying tank and unloading	5
Risk and profit, 25 per cent .	5
Cost of a load of 50 feet	20s.

Deals require to remain the tank three days, and an extra day for every inch in thickness.

The [illegible] tanks for mere saturation that I have any account of, were erected for the Great Western Railway Company, at Bull's Bridge, near West Drayton, under the direction of the engineer to the Company. These tanks were 9 ft deep, and of an oblong trough shape, the size at the top was 84 ft. by 1[illegible] ft., and at bottom 60 ft. by 12 ft. [illegible] The sides were of 4 in. plank, American pine, supported on sills 12 in. by 10 in., and upright framing 10 in. by 10 in. and with sloping diagonal braces 8 in. by 8 in., of which framing there were 9 sets in the length of the tank. The whole was sunk into the ground nearly level with the surface, the framing standing about 2 ft above the sides, to which were attached transoms to keep down the timber in the solution. The tendency of the timber to float was so great, that notwithstanding the bearing was only 10 ft., and the transoms 15 in. by 12 in., they were cambered or bent upward nearly an inch and a half, and in one instance the whole tank was disturbed from its seat, the thickness of the sides being only 4 in. plank, the solution escaped, and ran into a ditch which communicated with a fish pond at a distance of about 600 yards from the tank and notwithstanding the reduction in strength, the fish in the pond were killed.

The sublimate was dissolved in hot water, and added to the water in the tanks the hydrometer being used to test its strength. At the end of the tank a mast was erected with a traversing boom, so as to be used as a derrick in filling or emptying the tank of timber. As a test whether the solution

had penetrated to the centre of the timber, hydrosulphuret of ammonia was used, and if the solution had penetrated sufficiently into the prepared timber, being touched with the test a black stain would soon become apparent, although I must say I have not seen it yet successfully when the timber was split far from the surface.

The preservation of timber from the dry rot is at the present moment attracting considerable attention in consequence of Sir W. Burnett's process having superseded Mr. Kyan's in the good opinion of the authorities of the navy. The *United Service Journal* for April has an article on naval improvements in the 19th century, from the fourth notice on dry rot, is ... the following account of Burnettizing. It appears that Sir W. Burnett, Physician General of the Navy, knowing that the precipitate caused by Kyanization was soluble in sea water, substituted water saturated with the chloride of zinc, with decided and beneficial effect, and "we trust," says the editor of the *Journal*, "the day is not far distant when no wood of timber ... canvas will be used in Her Majesty's service without being Burnettized." The principle of Burnettizing was reported upon by the Master of Woolwich Dockyard and his assistant, 10th July, and by the Admiralty 26th July 1841. Tanks are established at each of the dockyards, at Portsmouth, Plymouth and Chatham; that at Portsmouth is 6 ft. diameter, and ... ft. long, and proved to a pressure of 200 lb. on the inch. In consequence of the successful results of all the experiments, Sir William was induced to take out a patent. In the above named Journal, amongst the correspondence, is a letter from the Liverpool Registry of Shipping, stating that rock salt ... between the timbers of the frame of a ship is a preventive or cure for dry rot, even after it has made its appearance. In the *Mining Journal*, March 18, 184..., from a letter by J. Murray, we learn that he applied sulphate of iron and a putrid ... caused ... to resist the penetration of the ... 10 years before ..., through the same ... states that salts of copper will ... as well as chloride of mercury. The tanks of the Hull and Selby Railway previously noticed are more fully described in Vol. ..., page 20... of the *Journal*, ... account of the meeting of the Institution of Civil Engineers, March 8, 1840, where it is stated that 50 out of 70 of the prepared sleepers, used at the West India Dock warehouses, after being down for five years were ... they had been prepared by simple immersion or saturation, and it is ... that ... the Anti-Dry-Rot Company ... the solution was kept ... and that the action of corrosive sublimate would be prejudicial to the ... bolts in Kyanized sleepers.

In the application of Kyanizing to railways, Mr. Giles was the first to apply it on the Southampton Railway, and of its application to building, Sir Robert Smirke at the ... 18..., also at the Custom House, Bristol, the Oxford and Cambridge Club, and the British Museum; also by Mr. Wilkins in ... the National Gallery, and by Mr. Barry at the College of Surgeons ... and in the same year by Mr. ... at the Westminster Bridewell, and it has been also employed at Kingsgate Harbour by Andrew Turnbull, C.E. The above enumeration of works, in addition to the attention bestowed at the meeting of the Institution of Civil Engineers, ... I think evidence enough to show that Kyanizing has not been superseded in public estimation by Burnettizing without a fair trial of its merits. Both processes, I think, will fall into desuetude not from any defect in principle or not answering the end in view, but from the ... cost of the tanks, the delay in time, the vessel not being capacious enough, and the extra delay and expense in delivery and cartage of the materials from place to place, or from the tanks to the works where the materials are required. Thus, I know that the Kyanizing has signally failed in taking root in the provinces, and I could specify at least ten places where it has been given up. With respect to a railway with two lines of rails ... the cost per mile will be as follows, where cross sleepers are employed, each sleeper contains from 2 to 2½ cubic feet, and costs from 1... to 1s ...d each for Kyanizing, exclusive of cartage from the place of delivery to the Anti-Dry-Rot station and from thence to the works where they are required ... The cost of sleepers of Scotch fir is about 4s each, and of larch ... price, of course ... by the locality, taking, however, the cost of Kyanizing and cartage at 1s 6d per sleeper, and a double way, and placing the sleepers 3 feet apart, although recently they are placed only 2 feet 3 inches apart, and there being 1760 yards in a mile, the total cost of Kyanizing will be £132 per mile, which on some of the long lines amount to the sum of £20,000, an amount which ought not to be too rashly entered on without due inquiry.

In conclusion, I beg to be allowed to state that I was engaged in the use of the Kyanizing when Messrs. Grissell and Peto employed it, also, in the erection of the tanks of the Great Western Railway Company, and in the superintendence of the process; when performed by local establishments, of the Anti-Dry-Rot Company. I state this, to show that my opinion is not rashly formed, when I say that Kyanizing is grown into disuse, and that probably Burnettizing will also share the same fate, perhaps, without having so long a trial. With the concluding remarks of the Lecturer on Engineering at King's College, as given in a late number of the *Journal*, I cordially agree, viz., "It is use alone that sanctifies expense." Although this paper may not possess the merit of being thoroughly original, yet I think it may claim no lack of inquiry into the writings of previous inquirers as to the merits of the question of preventives to decay in timber. To yourself my thanks are especially due for your liberality and condescension in noticing my previous efforts, as a correspondent to your valuable periodical, amongst the general notices as being the results of labour, and as valuable communications, but more especially for the particular notice in Vol. ..., page ...07, where my efforts are ... of great utility." Your kindness has given my ... an ... object which is to employ my leisure profitably in the advancement of knowledge, and becoming of practical utility to my fellow men.

St. ... Newcastle ... O. I.

NEW PROCESS FOR MANUFACTURING LIME, &c.

A Patent has been granted to WILLIAM EDWARD NEWTON, of Chancery Lane, for *improvements in manufacturing lime, ... artificial stone, and such other compositions ... applicable to working under water, and in constructing ... which ... exposed to damp.* (A communication.) Sealed the ...d of April 1841.

This invention consists, Firstly—in the ... processes of ... hydraulic lime and cement, which has the property of becoming hard and solid when under water, or exposed in damp situations. Secondly—in the application of the same principles to the hardening of soft stones for the purpose of making hard artificial stones. Thirdly—in the employment of the same process for hardening, and ... preserving iron from the effects of damp, &c.

The following is the principle upon which the invention is founded, and the methods employed for carrying it into effect. The property which certain sorts of lime possess of being hydraulic, or hardening under water, is caused by a certain combination of the lime with silica, alumina, and sometimes also with oxide of manganese and oxide of iron. The object then of this invention is to facilitate the combination of the lime with those oxides by means of agents not hitherto employed. Thus in operating by the dry method, as is generally the case, instead of calcining the lime stone or lime with sand and clay, the inventor, in order to facilitate the combination of the silica and alumina with the lime, introduces a small quantity of potash or soda in the state of carbonate, sulphate or chloride, or of any other salt of these bases susceptible of decomposition, or becoming a silicate, when such calcination takes place. The salt of potash or soda, the quantity of which varies from three to six per cent. to the quantity of lime, is employed in the state of solution, so as to penetrate and mix better with the alkaline salt in the chalk or slacked lime. Calcination effects the rest, in the ordinary manner.

In order to combine or incorporate more equally, by the dry method, the alumina and the oxides of manganese and of iron with the lime, the sulphates of these bases are first decomposed by the slacked lime, by making a paste with a solution of the sulphates mixed with the lime. This paste into which the sulphates in question enter in the proportion of from six to ten per cent. of the lime, is then calcined, in order to produce an hydraulic lime. All sorts of lime are made hydraulic, by the humid method, by mixing slacked lime with solutions of alum or sulphates of alumina, but the best method consists in employing a solution of the silicates of potash or of soda, called liquor of flints or soluble glass. An hydraulic cement may also be made, which will serve for the manufacture of architectural ornaments by making a paste of pulverized chalk and a solution of the silicate of potash or of soda; in working with this plaster, it becomes much harder than ordinary plaster.

These same silicates of potash or soda, dissolved in water, will also harden chalk, or soft and porous stones, and transform them, artificially, into hard stones. In order to do this, these soft stones, either rough, or cut into their proper forms, must be soaked in a solution of the silicate, either warm or cold, and allowed to remain there a longer or shorter time, according to the degree of hardness which it may be necessary to give them, after which, they must be taken out and left exposed to the air. At the end of a few days, stones, thus prepared, will have acquired a hardness equal to that of marble, and this quality, in a little time, pervades the whole mass, for if, for the purpose of polishing, the outer coat or surface be removed, the inner one, which at first is not so hard, will harden in its turn, by exposure to the air. This takes place as far as the silicate has been able to penetrate. A more superficial hardness is obtained, by applying the solution of the silicate

of potash or soda, by means of a brush. It is in this manner that walls, constructed of chalk and mortar, may be hardened. Sculpture, and various other objects, which may be made or prepared in chalk, may be hardened, and afterwards serve for decorating buildings, and other purposes, without the fear of their becoming injured by frost or damp. Chalk, hardened in this manner, may also be used as a substitute for the stones now employed by lithographers. Plaster models may also be hardened, by placing them, for some time, in a solution of the silicate; but it would be still better to add a portion of the solution to the paste, at the time of making the model, or using the plaster. The silicate of potash or soda is prepared by fusing one part of white siliceous matter with from one and a half to two parts of potash or soda, in the ordinary reverberatory furnaces, or in a glass-maker's or iron crucible. The solutions may be used of any density for plaster, but they should be weaker for chalk. In the last place, the inventor has found that the silicates of potash or soda, when dissolved in water, decompose spontaneously in the air, and cover the objects, to which their solution has been applied, with a strong covering or layer, therefore by applying the solution of silicate of potash, or of soda to polished iron, and allowing it to dry in the air, the metal is preserved from oxidation. By soaking wood many times in this solution, and allowing it to dry in the open air, every time after it has been placed therein, it becomes so much penetrated with silica, that it acquires a considerable density and degree of indestructibility.

The solution of the silicate of potash is not the only substance which by being injected into porous bodies tends to harden them. A mixture, made from a solution of bicarbonate of ammonia, and of chloride of magnesium, may be successfully employed, or a mixture of the solutions of common [illegible] and chloride of calcium may be used. In these latter cases instead of having silic[illegible] injections, they are either mag[illegible] [illegible]. Soft and porous stones may also be considerably hardened and defended from the action of damp, by first well drying them and then dipping or steeping them in sulphur, or some natural or artificial resinous or bituminous substance rendered liquid by heat.

The patentee claims, Firstly,—the application of certain new means to change or convert all descriptions of lime into hydraulic limes and cements, or such as become hard under water, or when exposed in damp situations, by combining these limes and cements with silica, alumina, the oxide of manganese, or the oxide of iron, either by the dry or humid method. Secondly,—the manufacture of [illegible] stones from chalk, plaster, and all porous stones in general, by injecting into them, or imbuing them with silica, or the carbonates of magnesia or lime, by any of the above described processes, or by causing them by virtue of their porous nature, to absorb either melted sulphur or bituminous resinous or fatty matters, properly liquified by means of heat. Thirdly,—in the employment of the silicates of potash or soda for making or forming artificial stone, plaster, or coating upon a variety of substances, thereby preventing iron from becoming rusty or oxidized, and rendering wood and other organic matters harder and not liable to decay.—*Enrolled in the Petty Bag Office, September, 1841.* *London Journal.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

February [illegible].—The President in the Chair.—(*Continued.*)

The Thames Tunnel.—Sir M. Isambard Brunel presented a design intended to illustrate the mode of securing the poling boards of the shield of the Thames tunnel. The poling boards, shown in the drawing, he described as being intended to close the whole area of the excavation in the front, as the side and top staves were intended to secure the sides and top of it. The shield (weighing nearly 180 tons) in passing over the ground, served materially to compress it, and make a firmer foundation for the tunnel. When it was considered that the mass of ground removed weighed 6[illegible],000 tons, while the brick structure by which it was replaced weighed only 2[illegible],160 tons, some idea might be formed of the difficulties which had been encountered in the progress of this undertaking. It would be seen by reference to the early reports, that [illegible]40 feet of tunnel had been made in the course of sixteen months, viz., from the 1st of January 1826, to the 27th of April 1827. At that period the miners and bricklayers struck, without even securing their work. In this emergency, after standing still [illegible] week, new hands were engaged, the result was, that on the 11th and 12th of May, the ground showed symptoms of giving way, and on the 18th the river broke in and completely filled the tunnel, the length of brickwork then completed was about 5[illegible]0 feet. He was convinced that no irruption would have occurred but for the desertion of the men, for at no previous period had so much work been done, the average progress being 12 feet per week for sixteen weeks, and having at that time the advantage of his son's services and those of experienced assistants, the work might have continued, and the tunnel would have been finished in about four years. After this irruption, an advance of only 50 feet was made within the period of the year 1827, and in consequence of a second irruption, the work was totally abandoned. In the year 1835, after a lapse of seven years, being liberally assisted by the Government, a new shield was provided, and the work was resumed in the beginning of March 1836. The work, however, proceeded very slowly as contrasted with former periods. On the 11th of June the water broke in and continued to trouble the works for six weeks. Having succeeded in repelling this attack, the progress for the whole year amounted to 117 feet. Foreseeing that he should at some future period, have to account for the causes of these delays, Sir Isambard instituted, in the course of the year (1836) distinct sets of records for every branch of the service, afloat as well as underground, in order to place beyond doubt, the circumstances which might not otherwise be credited. These registers enabled him to give the minutest details of the work, and would, he hoped, be found useful in any future similar undertaking. Through the whole of the year 1837, the progress was only 28 feet 4 inches, a rate which hardly exceeded that of a fortnight of the year 1827. Two irruptions took place within the range of eight feet, owing to the looseness of some portions of the strata, which were so fluid that the only expedient for advancing was by forcing forward some of the polings with the screws. The frequent bursts of gas at that period, and in 1838 and 1839 had moreover such an effect upon the men, that some of them fell senseless at their post. There was therefore great risk of the poling boards falling down, as had been the case before, and causing a total disruption of the ground. In this dilemma the expedient of connecting the poling boards with each other by hooks was resorted to, forming by this means a complete panel in the face of each of the 36 cells of the shield; the top poling being suspended to the head of the cell, the panel could not be disturbed even with a cavity in front of it; there was likewise an additional means of supporting the polings, by iron spurs resting upon the floor-plates and going into the ground. Notwithstanding the apparent increase of labour occasioned by this addition to the poling boards, good progress was made, amounting to 249 feet in the course of twelve months, and the hooking was found so safe in its service and its results, that were another tunnel to be constructed, Sir Isambard stated, that he would make the system of attaching the poling boards an essential part of the organisation of the shield, being convinced that it might by this means, be worked through the worst ground with a certainty of safety and success.

February 14.—The President in the Chair.

"*Description of Mr. Clay's new Process for making Wrought Iron direct from the Ore, as practised at the Shirva Works, Kirkintilloch, Scotland.*" By William Neale Clay.

In this communication, the author first describes the various stages through which the metal passes between the reduction of the ore and its arriving at the state of malleable iron by the ordinary mode of manufacture, and then he explains the process which he has invented and introduced practically at the Shirva Works.

By the ordinary system of iron making the ores are reduced into the state of carburet of iron, and then by refining and puddling the metal is decarburetted, thus making it into malleable iron by a [illegible] of processes, which are recapitulated:—

1st. Calcining the ore.

2nd. Smelting in a furnace, by the aid of blast either cold or heated, with raw coal or coke for fuel, and limestone as a flux.

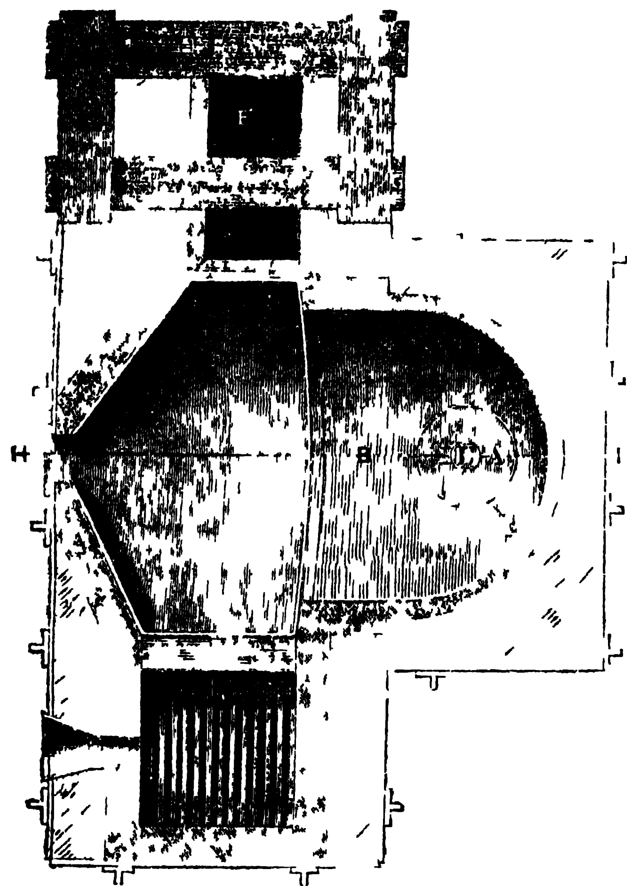
3rd. Refining the "pig" into "plate" iron.

4th. Puddling, shingling, and rolling, to produce the "rough," "puddled," or No. 1 bar.

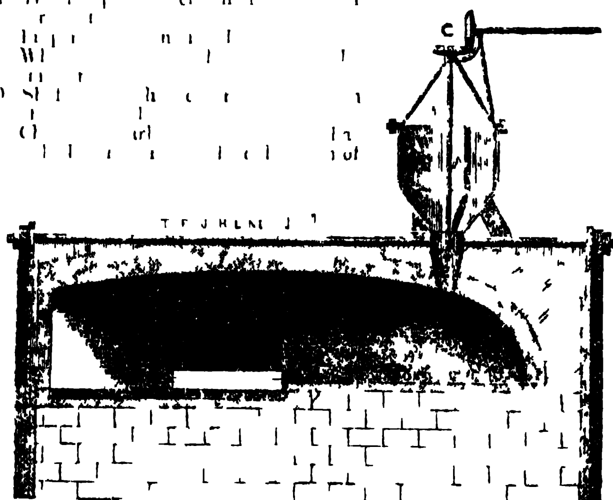
5th. Cutting up, piling, and rolling, to produce "merchant" or No. 2 bars.

6th. A repetition of the same process, to make "best," or No. 3 bars.

Seeking to diminish the number of manipulations, by the new process a mixture of dry Ulverstone, or other rich iron-ore (Hæmatite) is ground with about four tenths of its weight of small coal, so as to pass through a screen of one eight of an inch mesh. This mixture is placed in a hopper, fixed over a preparatory bed, or oven, attached to a puddling furnace of the ordinary form. While one charge is being worked and balled, another gradually falls from the hopper, through the crown upon the preparatory bed, and becomes thoroughly and uniformly heated, the carburetted hydrogen and carbon of the coal, combining with the oxygen of the ore, advances the decomposition of the mineral, while by the combustion of these gases, the puddling furnace is prevented from being injuriously cooled. One charge being withdrawn, another is brought forward, and in about an hour and a-half the iron is balled, and ready for shingling and rolling. The cinder produced, is superior in quality to that which results from the common system; it contains from 50 to 55 per cent of iron, and is free from phosphoric acid, which frequently exists, and is so injurious in all the ordinary slags; when re-smelted, it produces as much No. 1 and No. 2 cast iron, and of as good quality, as the ordinary "black band" ore of Scotland. The cast iron produced from the slag (amounting to one-third of what was originally contained in the ore) is mixed with the ore and coal in the puddling furnace, and thus, while nearly all the iron is extracted from the ore, as much wrought iron is produced in a given time, and at the same cost of fuel, as by the old system. The first process, producing puddled bars of superior quality, is consequently on a par with the fourth stage of the old system, as it avoids the necessity of the preceding separate manipulations. From the absence of all deleterious mixture, by once piling and reheating the rough [illegible]



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ars no t s produced of a quality in very respect equal, and in powers of tension superior to that which results from the second piling and reheating of the common mode. It is therefore contended that the two processes produce from the ore nearly one third more iron of as good a quality as is usually obtained by the six processes of the old system. The iron thus produced takes a high polish, is very uniform in its texture, is ductile and tough, has more than an average amount of tensile strength, and at the same time appears to be more dense, as it possesses a peculiar sonorousness resembling that of a bar of steel when struck. It has also been converted into steel of a good quality.

The paper was illustrated by a drawing of the furnace necessary for the process and by specimens of the iron and steel produced.

Remarks.—Mr Clay contended that the ordinary method of making iron was neither so scientific, nor so practically good as there was reason to expect it would have been when iron formed so considerable an item in the productive industry of the country. His invention was in some degree based upon the old Catalan fire, wherein malleable iron was produced direct from the ore, although by a considerable expenditure of fuel: by his process the ore was also reduced at one operation into the state of malleable iron, by combination with a large portion of carbonaceous matter, and as the deoxydation of the ore could proceed simultaneously in an adjoining preparatory bed through which the flame of the puddling furnace traversed, there was necessarily a great saving of time, labour, and fuel in the production of the metal, whilst the quality was at the same time improved. He argued, therefore, that if the system was generally adopted a large portion of the capital now sunk in the expensive constructions of blast furnaces, blowing engines, &c. would be dispensed with.

Mr Taylor observed that the process appeared to be only applicable to the rich qualities of iron ore, which were now used in comparatively small quantities ... [fragmentary] ... from which ... for converting into steel ... 30,000 tons annually, ... Cornwall ... that could be raised. ... Swedish ... imported.

Mr Heath had examined Mr Clay's process ... and ... the wrought iron produced from ... tests ... hammered ... the ... the quality of welding like shear steel, without ... to ... hammer ... consequence of this ... the quality of steel was almost abandoned for cutlery ... generally used as it did not exhibit the luminated appearance when polished which shear steel frequently did. The metal was sounder and fewer ... All the brown hæmatites contained manganese ... little doubt that, by selecting the proper kinds of ore, malleable iron might be made in Great Britain by this process as good for converting into steel as any of the Swedish iron. There was abundance of specular iron ore on Dartmoor, equal to the Elba ore, and which would (he had little doubt) produce as good iron as that from the Dannemora ore.

Dr Faraday remarked that the process invented by Mr Clay was founded on sound chemical principle. It was desirable to abandon the use of limestone as ... it was proved that the purest limestones contained phosphate, which, although advantageous in agricultural processes, ... detrimental to iron making.

Mr Fox had tried some specimens of Mr Clay's iron and found them to bear strain ... as well as the best cable bolt iron made in the ordinary manner.

Mr Clay explained that Mr Heath's process was not indispensable for converting into steel ... his method ... and also that argillaceous iron ores after calcination could be treated in his furnace, like the hæmatite ores, but not so advantageously.

Mr Taylor said that 25,000 tons of steel were converted annually in this country ... of that quantity not more than 2,500 tons were made from the best Swedish iron, for the remainder inferior qualities of iron, such as Russian iron, marked CCND from the forges of Monsieur Demidoff, were used. All that iron was made with charcoal, and could only be called inferior when compared with that made from the Dannemora ore. If Mr Clay's process was successful in treating the hæmatite ores, ... it was of great importance, as ... would emancipate the country from a dependence upon foreign products. He had recently seen in Germany, a process of producing steel by stopping the operation of puddling pig iron at a certain point or intermediate state between cast and wrought iron and hammering the mass at once into bars. The operation was one of much delicacy, and depended entirely upon the skill of the workman.

Mr Heath believed the manufacture of steel was involved in unnecessary mystery; it was the general opinion that foreign iron was essential to produce good qualities. Iron as now made from coke furnaces certainly contained too much foreign matter to be used for steel, and it would require more attention to the selection of the materials, before pure iron could be obtained; some of the Low Moor iron, the good quality of which was universally admitted, had been made into blistered steel, but although the springs made with it appeared perfect, it was said that they did not answer so well as those made with steel from charcoal iron. The Sheffield manufacturers required that steel should possess 'nature and body," the first quality to enable it to be rolled and drawn out without cracking and the second that it might receive and retain a fine edge. Steel made from Garnderris iron (South Wales) possessed nature, but if made into cast steel it fled into pieces in working, as it did not possess 'body." Steel from German ores appeared to have 'body,' but wanted "nature." Steel from

Indian iron, although difficult to work, stood better than other kinds when once reduced into form; this he attributed to the purity of the magnetic ore from which it was produced; there was not the slightest trace of phosphorus, arsenic, or any deleterious foreign matter. He was convinced that, with a mixture of Indian pig-iron (which could be produced very cheaply) and Devonshire ore, by Mr. Clay's process, iron could be made of excellent quality for converting into steel at such a reduced price as would render the introduction of Swedish and other foreign iron unnecessary.

Mr. Taylor believed that improvement in the quality of steel, rather than reduction in the price, was the object to be sought. In the large quantity used in the mines under his direction, the dearest steel was found to be the more economical. He had seen as many as 12 dozen borers used to make one blast hole, and unless the tools kept their points well, the labour of the men was thrown away.

February 21.—The President in the Chair.

Mr. Giles presented a plan and sections of London Old Bridge made from his surveys of it in 1820, by order of the Committee of the Bridge Lands, with descriptive notes.

The plan represents the sterlings, piers, parapets and roadways of the old London Bridge, its low-water channels, called locks, with the soundings through the locks. The sections represent an elevation and levels of the sterlings, piers, arches, roadway, and locks, with levels of the tides observed at the bridge in September and October, 1820; the datum to these levels being the Trinity high water mark of London, which is recorded on a stone let into the lower external wing of the Hermitage entrance of the London Docks.[1]

From the plan it appears that—

	Ft	In
The aggregate waterway between the piers above sterling height was	524	2
The width occupied by the piers .	406	10
Making the total length between the abutments of the bridge .	931	0
The aggregate waterway below the sterlings at low water was	230	11
And the aggregate distance occupied by the piers and sterlings at low-water was	700	1
	931	0

The level of the tides shows—

	Ft	In	
The extraordinary high-water mark of springs to be	2	0	above datum
The average high water mark of springs between 23rd September and 25th October below bridge		6½	under ditto
The same above bridge			
Making the high-water of spring tides above bridge 7½ inches under the same high water below bridge owing to the obstruction which the piers presented to the tides attaining their full height above bridge, and this difference was found commonly to be 8 inches			
The average high-water mark of neap-tides above bridge was .			
And the difference of high-water of neap-tides below and above bridge was not observable			
The average level of low water mark above bridge was . . .	14		
The average level of neap tides low-water mark below bridge was .	16		
The average level of spring-tides low water mark was	18		

Thus the average fall of water through the locks of the bridge at neap-tides was 2 feet 1 inch, and the same at spring-tides was 1 feet 4 inches. But an extreme fall of 5 feet 7 inches was observed through these locks on the occurrence of a high land flood, and a spring tide ebb.

Having completed the surveys of old London Bridge, Mr Giles subsequently took the levels of the tides from thence to Teddington lock, and found that in the absence of high winds and land floods the high-water of spring-tide on the upper side of London bridge attained its level or height at all the London bridges, also at Battersea, Putney, Kew, and Richmond bridges, and at Teddington lock.

"Account of a series of experiments on the comparative strength of solid and hollow Axles." By John Oliver York, Assoc. Inst. C. E.

The author first describes the causes of fracture in railway axles, which he attributes to the sudden strains and injury produced by concussion and vibration. Those resulting from concussion are chiefly ascribed to a defective state of the permanent way, any sudden obstacle opposing itself to the progress of the train, and the severe shocks arising from the wheels coming in contact with the blocks and sleepers when thrown off the line. The force of vibration and its certain effect to produce fracture in a body so rigid as a railway axle, is then fully explained, the evil arises from the impossibility of diverting from the axle the continued series of slight blows or vibrations to which it is subject, or of causing a free circulation of them through its entire length, since the naves of the wheels being fixed tightly on to the axles, form a point on either side for the vibrations to cease, and the particles of iron composing the axle at this point become dislocated by the continued and unequal strain, and ultimately break, the same action is described as taking place in the journal of the axle, and hence the fact that an axle seldom breaks excepting at the journal or at the back of the nave of the wheel. The twisting strain to which railway axles are subject is next considered, and a calculation entered into, to prove that upon a circle of only a few feet in diameter and assuming a first-class carriage on four wheels to weigh six tons, the strain resulting from this cause is so slight as to be unworthy of consideration in the inquiry. The paper next proceeds to point out how and why the hollow axle is better able to resist the strains before referred to, than the solid ones now in use.

First, by the process of manufacture by which the crystallization of the iron is avoided, and it is left in a better state for sustaining sudden strains and continued action. Secondly, by the position of the metal composing the axle, since the comparative strength of axles are as the cubes of their diameters and their comparative weights only as their squares, consequently, with less weight there must be increased strength; and thirdly, that the vibration has a free circulation through the length of the axle, no part being subject to an unequal shock from the vibration, and the axle would therefore receive much less injury from this cause. In conclusion it is submitted that a railway axle should possess the greatest possible degree of rigidity between the wheels, to prevent it from bending or breaking from concussion combined with the greatest amount of elasticity and freedom in the particles of iron within the axle itself, to prevent the injurious effects of vibration.

The details of a numerous set of experiments are then given, to prove the superiority of the hollow axle in all these respects, the average of the whole of which is thus stated. As regards rigidity to sustain a dead weight. The axles being supported at the ends, and the weights applied in the middle.

Hollow Axle						Solid Axle			
Weight				Deflection	Permanent set	Weight		Deflection	Permanent set.
Tn	Cwt	Q	lb	Inch	Inch	Tons	Cwt	Inch.	Inch.
	11						11	..	$\frac{4}{16}$
							1		$\frac{5}{17}$

As regards its capability to resist a falling weight.

? cwt 3 qrs ? lb falling from a height of 16 feet on to the centre of the axle.

Hollow Axle	in	Solid Axle	in.
1st blow, deflection	1¼	1st blow, deflection .	1⅞
2nd	2¼	2nd	3¼
3rd ,	3¼	3rd .	4¼

As regards the elasticity and fibrous quality of the journal.

Hollow Axle		Solid Axle	
Number of blows to destroy journal (average)	28	Number of blows to destroy journal (average)	10

Proportions of axles.

	Hollow Axles	Solid Axles.
Diameter	4 inches	3½ inches
Weight	1 cwt 2 qrs 20 lb	1 cwt 3 qrs 24 lb

The paper is illustrated by specimens of the broken axles, both hollow and solid, and by diagrams of the mode of manufacturing the two kinds of axles.

Remarks.—Mr Geach presented a series of specimens of ends broken off solid axles, made by the Patent Shaft and Axle Company, Wednesbury, they have borne severally 886, 148, 293, and 278 blows of a sledge hammer, weighing 38 lb before they separated from the body; above twenty more ends had been broken off, the weakest requiring 138 blows. The diameter of these journals was 2¼ inches. An axle was exhibited which had been bent nearly double under an hydraulic press, with a pressure of 64

[1] Low-water mark is 17 feet 10 inches below the lower edge of this stone, settled by the Corporation of Trinity House, August 1800, (39 and 40 Geo. III, cap 17 sec 55.)

tons: the journals (2½ inches diameter) were also bent in opposite directions, by repeated blows of the sledge-hammer, without any signs of fracture being perceptible. The firm, which Mr. Geach represented, had made upwards of 2500 axles, and had tried a very large number by breaking them they almost uniformly found them of good quality, which might be attributed to the mode of manufacture Around a centre bar of iron were placed eight bars rolled to a proper form to complete a circle, they were then welded together by rolling, and finished under the hammer, the fibre of the iron, it was contended was thus worked, and remained in its most favourable position He was not opposed to the principle of hollow axles, but he wished to prevent any unnecessary prejudice against solid ones by inferences from any one set of experiments, he would therefore suggest that another series of experiments should be made between the relative strength of the two kinds of axles for which he would contribute the necessary number of solid ones

Mr York described the manner in which the solid axles had been selected for the purpose of experiment Having obtained General Pasley's consent to be present on the occasion he ordered axles from the Patent Axle Company, and another eminent maker and selected also several other axles supplied by the Patent Axle Company to the London and Birmingham Railway these axles were new never having been under any carriage, he contended that the result of the experiments afforded a fair specimen of the axles generally in use and were such as the public were in the habit of riding upon The axles which had since been made by the Axle Company and were then exhibited to the meeting, showed a quality of iron which could not be surpassed if this was the usual quality made use of by that company it still more forcibly proved his position as to the uncertainty of manufacturing solid axles, for while one specimen took a great number of blows to break it the majority of them were fractured by a slight force it was this uncertainty which he proposed to avoid and he contended that it was inseparable from the method of making axles described by Mr Geach for in passing the faggot through the rolls to weld the bars together it frequently happened that they were only united to a depth of one half or three quarters of an inch hence it was to a certain extent hollow and partially avoided the injurious effect of hammering it, on the contrary they were perfectly welded, the iron became crystallized as in any other solid axle this fact was proved by the specimens before the meeting those that were solid having been broken by very little force and the unsound ones requiring a great number of blows to produce fracture In the experiments the hollow axles had broken under a different number of blows but this was owing to their having been made of larger diameter in the journals than the solid ones (but with only an equal quantity of metal in them) and afterwards turned down to the same diameter which left them of unequal thickness and too thin for a fair test, still however, with less metal than the solid ones they were stronger this might be accounted for by the mode of manufacture, as by retaining the axle hollow the crystallization of the iron was avoided The present mode of making the hollow axles he described to be by taking two trough shaped semicircular pieces of iron bringing their edges together and welding them under a hammer between swages He however dissented from the process of hammering, and intended to finish his hollow axles by compression only This he contended, would avoid the injury done to the iron by the present mode of manufacture and that with the same quantity of iron, the strength of axles being as the cubes of their diameters and their weights only as the squares a hollow axle must possess considerable advantage over a solid one Hollow axles had long been considered desirable, but the expense of making them had hitherto prevented their use, he had reduced their cost by his process to the same rate as the solid ones, and felt confident that in bringing them under the consideration of the profession, through the Institution, they would be fairly treated and ultimately adopted

General Pasley confirmed the correctness of the results recorded by Mr York, and the satisfactory nature of the experiments, which had impressed him with a favourable opinion towards hollow axles It was of importance to avoid deflection, as it was almost as fatal as fracture in causing accidents After the late accident on the North Midland Railway he observed a solid axle bent into the form of the letter C and the upper portions of the periphery of the wheels nearly touching each other The hollow axles would certainly resist deflection better than solid ones of corresponding weight

In answer to a question, Mr York said that the iron was chiefly injured by the amount of hammering which it received in forging

Mr Taylor remarked, that the question of the amount of injury received by iron in working was discussed at the meeting of the British Association in 1842, and the effects of vibration and electricity had also been treated of by foreign engineers. It appeared to be generally admitted, that the great source of mischief was the cold swageing, which the iron received, in order to give the work a good appearance In order to test this, Mr Nasmyth subjected two pieces of cable bolt iron to 160 blows between swages and afterwards annealed one of the pieces for a few hours The unannealed piece broke with five or six blows of a hammer, showing a crystallized fracture, while the annealed piece was bent double under a great number of blows, and exhibited a fine fibrous texture The fact of the fibre being restored by annealing was well understood and practised by smiths, particularly in chain-making

Remar... could not entirely subscribe to the great benefit of annealing, was neither so ... after annealing one end of a hollow axle for 48 hours, ... pect it would have been, it was broken off by 82 blows, while the other (unannealed) end of the same axle resisted as far as 78 blows.

In answer to a question from Alderman Thompson, Mr. York said that he had found as much mischief arise from over-heating iron as from over-hammering it, but the difference of the appearance of the fracture, indicated immediately when iron had been burned

Mr Taylor said that in Mr Nasmyth's experiments, the over-heated iron was almost as fragile as glass

Mr Gravatt believed that vibration, whether caused by the smith in working the iron, or by the use to which the bar was appropriated, was the reason of its fracture, and it was certain that a constant change was going on in all manufactured iron At the Thames Tunnel the "fleeting bars" used as levers for turning the large screws for forcing forward the shield, never lasted longer than three or four weeks, although they were very strong, and were made from the best materials by careful smiths They were only used occasionally, and then without any concussion, having only the power of eight men exerted upon them yet they broke constantly, and the fracture exhibited a bright crystallized appearance It was found at last, that in order to give them duration they should be left rough, and not hammered much in working

Mr Newton observed that full 10 years since Dr Church had used hollow axles for his experimental steam coach on common roads, being convinced of their superiority

Mr Fox was an advocate for the hollow axles but he did not consider the present experiments quite conclusive as there were differences in the relative dimensions of the axles experimented upon, he would suggest another series of trials, upon a larger number of axles, as the subject was one of great importance, not only to manufacturers but to the public whose safety in travelling depended upon the goodness of the axles under the carriages He had used upwards of 5000 axles made by the Patent Axle Company and had made many experiments by breaking them the average result was equal to that quoted by Mr York He agreed in the danger arising from over heating iron as also from over hammering it, and for some time past he had caused all the axles to be made six inches longer than was necessary in order to cut three inches off each end to try the quality and the appearance of the fracture of the iron

The President remarked that there could not exist a doubt as to the greater strength of a hollow axle as compared with a solid one both containing the same weight of material, the principal question to be considered was, that of vibration and its effect upon the cohesive strength of the metal, whether the action upon the particles was more irregular in the solid body and more distributed in the hollow one he recommended this investigation to some of the mathematicians who were present the result of their inquiries might materially aid in the development of truth from the practical experiments

February 28 —The PRESIDENT in the Chair

'*Description of the Roofs over Buckingham Palace, covered with Lord Stanhope's composition*' By Peter Hogg, Assoc Inst C E

The mixture invented by Lord Stanhope and used by the late Mr Nash, for covering the nearly flat fire-proof roofs of Buckingham Palace, is described in the paper as being composed of Stockholm tar, dried chalk in powder, and sifted sand, in the proportions of three gallons of tar to two bushels of chalk, and one bushel of sand, the whole being well boiled and mixed together in an iron pot It is laid on in a fluid state, in two separate coats each about three eighths of an inch in thickness, squared slates being imbedded in the upper coat, allowing the mixture to flush up between the joints the whole thickness of the two coats, and the slates being about an inch The object in embedding the slates in the composition, is to prevent its becoming softened by the heat of the sun, and sliding down to the lower part of the roof, an inclination being given of only 1½ inch in 10 feet, which is sufficient to carry off the water, when the work is carefully executed. One gutter, or water-course, is made as near to the centre as possible, in order to prevent any tendency to shrink from the walls and also that the repairs, when required, may be more readily effected It is stated, that after a fall of snow it is not necessary to throw it from the roof, but merely to open a channel along the water-course, and that no overflowing has ever occurred; whereas, with metal roofs it is necessary to throw off the whole of the snow on the first indication of a thaw These roofs have been found to prevent the spreading of fires, and it is stated, that on one occasion, to test their uninflammability, Mr Nash had a bonfire of tar barrels lighted on the roof of Cowes castle. Another advantage is stated to be, the facility of repair which the composition offers, as if a leak occurs, it can be seared and rendered perfectly water-tight, by passing a hot iron over it, and when taken up, the mixture can be remelted and used again. The author proposes to obviate the disadvantage of the present weight of these roofs, by building single brick walls at given distances, to carry slates, upon which the composition should be laid, instead of filling the spandrils of the arches with solid materials, as has been hitherto the custom.

The reported failures of this species of covering at Mr. Nash's house in Regent Street, and in other places, are accounted for by the composition having been used in one thin coat, laid upon an improper foundation of laths and tiles The durability of the roofs, which were carefully constructed

with good materials, has been, it is contended, fully proved at Lord Palmerston's house, which was covered with the composition in 1807; Lord Berwick's, in 1810; Sir James Langham's, in 1812; the Pavilion at Brighton, in 1816 and 1823; and nearly the whole of Buckingham Palace, in 1826 and 1829; the latter roofs are stated to be in perfect order at the present time, and have scarcely demanded any repairs since their completion.

The paper is illustrated by a drawing, showing the mode of constructing the roofs, and the improved method proposed by the author, with specimens of the composition, with slates imbedded, taken from the roof of the palace during some recent alterations.

Remarks.—Mr Poynter presented a drawing of the mode of setting the pots for melting and preparing the composition the proportions of which he stated somewhat differently from those given in the paper. Three measures of ground chalk, dried and sifted very fine, were mixed and kneaded up with one measure of tar, these ingredients were melted in an iron pot, set in such a manner that the flame should not impinge too violently upon it. The first or "skimming" coat of the covering being laid on of a thickness of $\frac{1}{16}$ inch, the finishing coat was composed by adding to the former mixture three measures of hot sifted sand, well mixing the whole together; the composition was laid on with a tool similar to a plasterer's trowel, but much stronger. Mr Nash, when he first tried the composition found that the surface became disintegrated by exposure to the weather, he therefore added the slates imbedded in the second coat, and subsequently never used the mixture without them.

Mr Nixon, in reply to questions from the President and other members, stated, that he was employed under Mr Nash when the palace roofs were executed, and he could bear testimony to their durability and soundness. The roofs at East Cowes castle, which were covered with the composition in the year 1808, and those of the Pavilion at Brighton in 1816 were now in as good a state as when they were finished. The failure at Mr Nash's house in Regent Street, arose from the roof having been originally composed of mastic, which soon cracked. One coat of the Stanhope composition was spread over it to stop the leaks but it was insufficiently done, and ultimately Mr Rains had a new roof, properly constructed with two coats of composition, which had remained sound to the present time. The price of these roofs, when well constructed by the person who did those of the palace, was about five guineas per square.

Mr Hogg observed, that the chalk was only exposed to such a heat as would evaporate any moisture it contained. The weight of the two coats of Stanhope composition, including the slate imbedded in it was about 12 lb per superficial foot.

Mr Sibley considered the Seyssel Asphalte, when carefully laid preferable to any composition of a similar nature: he had used it extensively, and was well satisfied with it, both for roofing and paving.

Mr Hogg objected to the use of asphalte for roofing as it was liable to injury; being of a brittle nature, it was not elastic, and it shrunk from the walls thereby causing leaks. Lord Stanhope's composition did not possess these faults, and he did not consider that it was superseded by asphalte.

Mr Moreland had covered the roof of the tread mill at Giltspur Street Compter with asphalte and had found it answer perfectly. It was laid on in a thickness of $\frac{3}{8}$ inch upon roofing boards $\frac{3}{4}$ inch thick with canvas nailed on them, with an entire fall of only 9 inches: there was no appearance of leakage.

Mr Davidson had caused a school room to be floored with asphalte four years ago, and up to the present time there was no symptom of wearing down, although the stones which were let into the floor, for supporting the desks, &c. were considerably abraded. He believed that the only failures of the asphalte had occurred from the use of inferior ingredients. Gas tar had been used instead of vegetable tar, and in those cases the result had not been successful.

ON BRIDGES.

At the ordinary general meeting of the Royal Institute of British Architects, held on Monday evening, the 15th May last, Professor Hosking illustrated and explained his proposal to improve the design of arched bridges, by the introduction of a transverse arch, groined into the longitudinal arch or series of arches, and showed the effect of this and of other suggestions he has made for the improvement of bridges, in a design for remodelling Westminster Bridge.

Mr. Hosking began by stating that the closely attentive consideration of the subject of bridge designing and building, rendered necessary by his engagement with Mr. Weale to supply a practical treatise for the extensive work on the Theory and Practice of Bridges, now lately published, gave rise to some suggestions of improvements in design and construction, which he believes to be novel, and knows to be (as far as he is concerned) original.

His object, on that occasion, was to explain and illustrate the more important suggestions he had made, that they might not be misunderstood, and might be more extensively known than they were likely to become whilst they rested within the covers of a professional library book.

On a former occasion in that room he had made some remarks upon the subject of bridge building generally, and had urged that the piers of bridges were built of much greater substance in thickness than was necessary for either safety or agreeable effect; that they might therefore be greatly reduced in bulk both for economy and for their effect upon the water way, and without diminishing their efficiency. It had been objected to him, however, at that time by some of the members—with the too common fault of architects, who would sacrifice use to effect, instead of compelling the useful to be effective—that his proposal tended to destroy the due proportion in appearance of the pier to the opening. The eye that had been accustomed to the bridges upon the Tiber at Rome, of which the piers are rarely less than one-third the span of the larger of the two arches resting upon them respectively, would be offended by the absence of that proportion of solid to void in London and Waterloo Bridges, in which the same relation is but one sixth, whilst the eye accustomed to the bridges upon the Thames at London, would condemn the bridges at Staines, and the bridges of Jena and Neuilly on the Seine, of which the piers are but one-eighth, one-ninth, and one-tenth of the span of the arches resting upon them. Nor have we yet reached the limit to which the diminution of proportion may be reduced with safety and good effect. Further to justify such further reduction, was one of the ends to be answered by the arrangement he was then to explain, which has the effect of reducing also the weight to be sustained by the piers of an arched bridge. The idea had occurred to him and he had matured it so far as to be able to speak of it with confidence on the former occasion alluded to above, but as he was then unprepared with illustrative diagrams he had thought it better to withhold it for the time.

The proposed improvement consists in groining a bridge arch, or in carrying a groined transverse arch through the length of a series of arches; and the advantages derivable from this plan consist in lessening the weight of the bridging constructions; in reducing the thrust upon the abutments, and consequently confirming the stability of both arches and abutments; in diminishing the liability of the bridge constructions to vibrate under the action of pulsating or of rolling bodies; and generally in greatly reducing the cost of construction.

The weight is obviously lessened by the difference between the massive haunches of the main vaults, and of the requisite backing to them through the extent of the transverse arch, and the comparatively light inner transverse arch, which being of slight span may be of stones of much less depth than the main vaults require, the thrust of the main vaults is clearly dissipated throughout so much of the width of the bridge as the inner transverse arch occupies, and so that if the latter occupy the proportion of the width that might be given to it, the abutments of the bridge may be reduced to mere wing walls, the vibrations arising from the traffic upon the bridge are checked at the groin points as at nodal points in a vibrating cord—and the groin is directly under the carriage road where alone any action that could be felt in the heavy mass of masonry can arise,—and the cost of construction is reduced by the reduction in quantity of the materials in the piers and in the vaults—by the reduction of labour required for the softer stone available for the inner transverse arch, and by the lighter centering sufficient for the same.

He had endeavoured to illustrate his suggestions by applying what he proposed upon a compartment of London Bridge, as a familiar instance, but without any idea of reflecting upon the existing condition of that magnificent work. [Here Mr Hosking explained the diagrams which were merely enlargements of the plate which illustrate the same subject in the Treatise on Bridges.]

The only indication of such an arrangement as that he suggested, in any existing work with which he was acquainted, is in Perronet's Bridge of St. Maxence, where low arches are introduced over the divided parts of the piers transversely of the bridge to take the springings of the great longitudinal arches but these have neither the intention nor the effect of what is proposed and are a source of weakness and expense rather than of economy and endurance. [The diagram which illustrated this, showed that the transverse arch was low and that instead of rising to the full height of the great longitudinal arches, and must therefore exert a great thrust upon the divided portions of the piers which abut it and as the vaults spring upon the backs of these transverse arches, there is no relief either in thrust or weight, by groining.]

He was well aware that the suggestion he had made was exposed to controversy upon the presumption that the transverse arch may not have sufficient abutment within the length of a pier transversely of the bridge, and as the theory of the groined arch has not been satisfactorily determined, if indeed it have been really investigated, he must claim to refer to experience and assert upon example that the inner arch as he had drawn it in the diagram, was superfluously abutted. Under any circumstances indeed, it can be only a question of greater or less span of the inner transverse arch with reference to the abutments afforded to it by the springings of the outer and greater longitudinal arch to which it is groined, since there can be no question but that if the abutments are sufficient to restrain the arch, the operation may be safely carried out. In the example the transverse inner arch occupies but half the length of the pier leaving the minimum abutment equal to half the span of the arch, with the means of increasing it to almost any extent by raising buttresses upon the heads of the cutwaters.

Numberless instances exist of arches of far less rise in proportion to their span than the present example shows, abutted only by the piers on which they rest, or rather by a substance upon their haunches extending only to the thickness of their piers, the piers being far less in proportion to the span than in the example, whilst the proportion of abutment to span should increase as that of rise to span diminishes. Trajan's Bridge over the Tagus

[2] Mr. Millson, No. 6, Frances Street, Tothill Fields, Westminster.

at Alcantara, the Pons Palatinus or Ponte Rotto upon the Tiber at Rome, the ruins of Augustus's Bridge at Narni, are cases in point, and every cathedral chapter-house in England in the pointed style of architecture, and every arcaded cloister, furnishes another instance to the same effect

Another question may arise as to the sufficiency of the area of the bearing surface upon the piers at the springings of the arches, for very much less is allowed than it has been usual to give in such cases

Perronet calculated upon experiments, that the stone of which his Neuilly Bridge was built, is capable of sustaining twelve times the weight imposed upon it in the piers of that bridge The area of the bearing surface of the piers of Neuilly Bridge, is about one-tenth of the area covered by the two half arches resting upon the piers respectively In the supposed case, the weight of the superstructure, as compared with Perronet's, is diminished by the introduction of the perforation in the arches, longitudinally of the bridge, and the stone of which London Bridge is built, being stronger than the stone used by Perronet in a much greater degree than the difference of their specific gravities would indicate, the substance of the arches built of the stronger stone, may be relatively reduced These circumstances operate to such an extent, that the weight of the superstructure is reduced as compared with Perronet's work, nearly, if not quite, one fourth, and as twelve times the sufficient strength is besides very much more than enough for the extremest contingencies it is not too much to assume that the area of bearing surface of the arches at the springings, or on the piers, may be taken at one-fifteenth the area covered by the two half arches In justification of this assumption, it may be added that without the same reason for it but with flatter arches, certainly, than at Neuilly Perronet made the area of the bearing surface upon the piers at the springings of the arches in the Bridge of St Maxence, and with the same stone of Saillancourt less than one-seventeenth the area in horizontal section of the space covered by two half arches.

But the granite used in London Bridge is of considerably more than twice the strength of the Saillancourt freestone in the bridges of Neuilly and St Maxence, and upon which Perronet's experiments were made and therefore the area of the bearing surface of the arches at the springings, may be one thirtieth the area in horizontal section of the space covered by the two half arches resting upon any pier

This is the proportion allowed in the case supposed, and the area of bearing face is upon the calculations regarding Neuilly Bridge and having reference to the different powers of resistance of the two kinds of stone more than enough for ten times the load it would be called upon to bear Having reference, however to other instances of the powers of stone to resist crushing pressure in the central pillars of some of the cathedral chapter houses it may be safely concluded that experiments upon small pieces of stone give results much within the strength of the material in the block, so that having counteracted the tendency of the traffic upon a bridge, to induce vibration in the structure by the introduction of the deep transverse arch groined to the flat longitudinal arches, it is believed that the bearing surface at the springings of the arches and consequently the piers under them, might be reduced, not merely with perfect safety but with great advantage very much beyond what he had now endeavoured to justify in the example before the meeting

Mr Hosking then proceeded to explain the advantages of corbelling out the parapets on bridges according to the method he has proposed in his treatise on Bridges and read some passages in explanation of them, from that work and showed, by diagrams, the manner in which the work might be composed constructively, and as to decoration, either plainly corbelled or enriched fases to the parapet He then resumed his remarks, and stated that in closing his observations upon the design and arrangement of bridges, he could not avoid noticing a pressing instance of an important work, within the personal knowledge of all who live in, or have ever visited London, rendered by circumstances which have grown up around it altogether unfit, both in its design and arrangement, for the position it occupies In September last he wrote, in the *Treatise on Bridges* as follows —

"It is difficult to close a *Treatise on Bridge Architecture*, without remarking the increased unfitness of the present superstructure of Westminster Bridge. The arches spring at a level very little above that of low water, where the tide rises and falls from 1. to 18 feet, so that the water-way is nearly 50 feet, or about one sixteenth less at the height of ordinary spring tides, than at the level of low water in the river The arches contract the way for navigation much more than it is at all necessary they should, even upon the present piers, and there is more than twice the height from the soffits of the arches to the level of the roadway than there need be, the parapets are alike offensive, by their great height from the roadway, and by their ugliness in detail, and injurious by the drafts induced by the perforations of the balustrades; and the solid counterfort buttresses over the cutwaters, and their unclosed and cupolated heads, add needlessly to the weight upon the piers. The bridge is unfortunately near to the magnificent buildings of the Houses of Parliament, and its great height renders this proximity more injurious than it might otherwise be. In all probability some abatement will be made of the height of the bridge in the process of the works now (1842) in hand for securing the pier, and doubtlessly the same good sense which [illegible]ed a view of the river from Blackfriars' Bridge will open the magnificent [illegible]pect Westminster Bridge can command, by substituting parapets, which [illegible]l be truly so, for the perforated walls which now hedge in the road-way; but the arches will still continue to render the navigable water-way narrower and more inconvenient than even the multiplicity and thickness of the piers, or the condition of the work, impose The character of the work, too, will still remain inconsistent with its position at Westminster. It ought, therefore, to be completely remodelled. As the piers are now in process of being repaired and secured, and so as to be free from any danger, founding new piers is out of the question, and the piers cannot be reduced in number without imposing additional weight on those which may be left, a condition which the original defective foundging, and the badness of the original structure, forbid The whole of the superstructure might be removed, however, and the piers being carried up from the level of the present springing to that of high water, of the substance which the cutwaters now show within that range, flat pointed arches might be sprung at that level, and the whole superstructure re-constructed in accordance with the prevailing style of the Abbey, Hall and Palace of Westminster The longitudinal central groining heretofore proposed might well be adopted with excellent effect, lightening the upper works, relieving the thrust of the arches, and greatly economizing the reconstruction, as the old stone would work in well for this purpose, whilst the faces and main vaults were of new The widening of the water-way by the removal of the springings of the arches out of the water would allow characteristic abutments to occupy the space now taken up by the two first arches of the series of thirteen, as well as the site of the two small land arches, without affecting the current injuriously, and as the flat pointed arch would give much more freedom to the navigation than the semi-circular arch affords, independently of the increased lateral space in every bay, the vertical head way might be taken at an average of that now afforded by the central group Moreover, the increased space at the approaches obtained by obliterating the useless land arches would allow the accesses to the bridge from the low ground on either side to be greatly improved, and the ascent eased by dividing them to the right and left over the abutments, and so to distribute the rise over a longer space, and give the means of dividing the going and coming traffic

These observations, continued Mr Hosking coincide in a very remarkable degree, with those upon the same bridge in the report lately presented by Mr Barry to the Commission on the Fine Arts, in connexion with the Houses of Parliament It was true that his suggestions stood alone in the particulars in which it was almost certain they would be peculiar, as it regards the introduction of the inner transverse arch groined to the main vaults, the increase of the span of the arches upon the same piers, (for he did not understand Mr Barry's report to contemplate that) and in widening winding and dividing the approaches for the double purpose of use and delight It was quite clear however, that as his remarks were written in September of last year and —with the wood-cut illustration of the subject which appears with the text—printed in October, though not published until February of this year, he might claim some credit for having taken the same view of subject that had already he doubted not, presented itself to the mind of the their eminent contemporary, whilst it might be held to strengthen, in some degree, the view they had both taken, that it had occurred to both Mr Barry and himself, without communication or knowledge indeed, of each other's doings, to support it by the same train of argument

ELECTRIC TELEGRAPH

Mr Whishaw the secretary, read a paper at the Society of Arts, on Wednesday May 17, explaining Messrs Cooke and Wheatstone's telegraph

The practical electric telegraph comprizes two modes of applying electricity to telegraphic purposes —1st The "Galvanometer, which acts by the deflecting power of galvanometer coils on magnetic needles," and 2nd The "Mechanical form which gives its signals through the agency of the Electro Magnet on Mechanism" Every instrument yet employed may be classed under one or other of these heads, and it is only fair to Mr Cooke to observe, that he had, previous to his acquaintance with Professor Wheatstone worked out in detail, and made several instruments of both descriptions and that he has alone thoroughly worked out the entire system on which these instruments are arranged for the purpose of making them act reciprocally

Mr Cooke by profession a military man, having served in our Indian armies several years, was in March 1836, engaged at Heidelberg in anatomical researches in connexion with the interesting pursuit of modeling his own dissections from nature, for the embellishment of his father's museum, a professor of the Durham University. In this self-taught art he had been engaged several months An occurrence about this time gave, however, an entirely new direction to his thoughts Professor Moencke of Heidelberg, had invited Mr Cooke to witness some experiments with a simple apparatus, intended to illustrate the idea of giving signals by electricity—an idea, by the way, which had at that time been before the scientific world for several years So powerful was the impression produced on Mr. Cooke's mind by these experiments, and so convinced was he of the possibility of applying electricity to the practical transmission of telegraphic intelligence, that abandoning his other pursuits, he devoted himself from that hour to the present moment exclusively to the practical realization of the electric telegraph—with what success, let those judge who have seen it working on the Blackwall Railway, for the last three years, or as now extended, and yester-

day (16th May last) brought into operation for nearly 20 miles on the Great Western Railway.

It is no slight proof of the energy with which Mr. Cooke followed up his great object, in contradistinction to the proceedings of others who had been experimenting with the subject for many years, that within three weeks of his first conceiving the idea, he had constructed at Frankfort two galvanometer telegraphs, capable of giving 26 signals, he had also invented the detector, by which injuries to the wires, whether from water, fracture, or contact, were readily traced, an instrument which Mr Cooke still retains in constant use; and without which, indeed, an electric telegraph would be impracticable he had also invented the alarum, on the same principle as one of those in use at the present day.

But the leading feature of the invention at this early period, and which still most strongly distinguishes it from that of Messrs Cooke and Wheatstone's telegraphs, and all others since exhibited in this country, consists in this, that the telegraph did not merely send signals from one place to another, but included a reciprocal system, by which a mutual communication could be practically and conveniently carried on between two distant places, the requisite connexions and disconnexions being formed by pressing the fingers upon keys similar in their action, and the signals being exhibited to the persons sending as well as to the person receiving the communication This was and still is effected, by placing a system of keys permanently at each extreme end of the circuit of wires, and by providing a draw bridge by which the circuit is completed for the electricity to pass when signals are received, but which is withdrawn when the signals are to be sent

This united and reciprocal property is the basis of the electric telegraph, and inseparable from the practical system, and must be borne in mind when the operation of these instruments is explained. Mr Cooke has since extended this instrument to any number of intermediate instruments included in the same circuit—as on the Blackwall line, where there are two sets, of five telegraphs each, working together—and also to the portable telegraph to be carried by the trains, and temporarily introduced into the permanent line of communication when required

By Mr Cooke's telegraph, eight simple signals can be given, and a sufficient number of compound ones, to admit of the 26 letters of the alphabet being used, in addition to which, by further conventional signs, those letters are made to represent figures, and by a mixture of both systems as was shown, a mixed sentence, consisting of passages from a code, spelling and figures, could be telegraphed together

Mr Cooke first adopted the plan of laying the telegraph wires in iron tubing on the Great Western Railway, and afterwards laid down a double line on the Blackwall Railway, and others on the Leeds and Manchester, and Edinburgh and Glasgow Railways This plan, though perfectly successful, was extremely costly and difficult to repair when injured though by aid of an instrument, the detector, less difficulty than could be supposed offered itself to the detection of the injured part, though buried and out of sight More recently, Mr Cooke invented, after extensive experiments at his own residence, and carried out on the Great Western Railway a plan of suspending the conducting wires in the open air from lofty poles Its leading advantages are—1st Diminished cost 2nd Superior insulation, 3rd Facility of repair The old plan consisted of laying copper wires, covered with cotton, and carefully varnished into smooth iron tubing—with frequent arrangements for obtaining access to the wires, and for the facility of examination and repairs The tube, after being carefully tarred, was either buried in the ground or fixed on low posts, and covered with a wooden rail This plan will still be occasionally applied in conjunction with the new one in tunnels, towns, &c

The cost of the original plan stands nearly as follows

	£	s	d
Prepared ¾ tube, varnished within and without, 5½d per foot	115	10	0
Six copper wires, covered and varnished, at £6 15s per mile .	40	10	0
Labour and carriage, per mile	27	0	0
Iron fittings, boxes, &c	12	6	0
Tar, pitch, paint, rosin, and sundries	15	0	0
Posts and rails, at 3½d per foot, including fixing .	77	0	0
The total cost of the original plan per mile	£287	6	0

* To which a per centage for casualties, profit to the contractor, and the price of instruments remains to be added

The cost by the present plan of suspension may be estimated thus

	£	s	d
Drawing posts, with winding apparatus, per mile .	48	0	0
Cast-iron standards, with insulators, (22 in a mile,)	52	0	0
Labour in fixing and painting	12	6	0
Anti-corrosion paint and tar	11	0	0
Carriage, tools, and sundries ,	13	0	0
Contingencies .	13	0	0
	£149	6	0

Making a reduction of about 50 per cent in favour of the present plan—and a still greater advantage in favour of the permanency of the work

The present method of proceeding in laying down the telegraph, is first, to fix firmly in the ground, at every 500 or 600 yards, strong posts of timber from 16 to 18 feet in height, by 8 inches square at bottom, and tapering off to 6 by 7 inches at top, fixed into stout sills and properly strutted. Attached to the heads of these posts are a number of winders for stretching the wires, corresponding with the number of conducting wires to be employed; and between every two of such posts, upright wooden standards are fixed about 60 or 70 yards apart A ring of iron wire, (No. 7 or 8,) which has been formed by welding the short lengths in which it is made together, is then placed upon a reel carried on a hand barrow, and one end being attached to the winder at one draw-post, the wire is extended to the adjoining draw-post, and fixed to its corresponding winder at that post, by turning the pin of the ratchet wheel with a proper key, the wire is tightened to the necessary degree, this is the greatest accuracy may be attained in drawing the wires up till they hang perfectly parallel with each other To sufficiently insulate the wires so suspended at the point of contact with the posts, is an object of indispensable importance, as the dampness of the wood during rainy weather would otherwise allow the electric fluid to pass off freely into the earth, or into an adjoining wire, and thus complete the circuit without reaching the distant terminus at which the telegraphic effect is to be produced To effect this object at the draw-posts, wooden boxes are employed to enclose that portion of the post to which the winders are attached, and small openings are left for the free passage of the wires, without risking any contact with the outer box The standards are furnished either with covers parted off by an overhanging fillet between each wire, and again between the lowest wire and the earth, or by a series of metal shields An eye of metal, with a slit on the upper side, forms a hook to support the wire, and to insulate the wire from the hook, which might otherwise act as a conductor to any dampness in the wood, a split quill is slipped over the wire on which it rests. The whole is then carefully painted with several coats of anti-corrosion paint, or asphalte varnish may be employed for the wires When the wires are to be varnished, they are unhooked from the upper ends of the standards and lowered to nails temporarily fixed to receive them toward the bottom of the posts A painter furnished with a can of paint, hung on his shoulder, a brush, and a piece of felt, takes each wire and rapidly coats it, when it is again hooked up in its position at the top of the standard. This is the simplest and cheapest method now adopted But for long distances Mr Cooke employs earthenware or glass for his insulation, and cast iron standards and posts with ash tops for drawing and suspending the conductors, which, instead of single wires, will be strands of six or more wires twisted together, for very great distances, when very superior conducting power will be needed, a copper wire will be placed in the centre of the strand, and whilst it adds but little to the weight, it will more than double the conducting power thereof the iron wire still giving the necessary strength to resist tension The relative conductive powers of copper and the softest iron wire are nearly as seven to one Various methods are adopted in passing under bridges which answer the purpose of draw posts, the winders being fixed to a piece of wood partly let into the brickwork to avoid damp, the greatest enemy to electric conduction These earthenware insulations are introduced between the winder and wire Mr Cooke also intends to use caps or boxes of earthenware to surmount the iron standards At Slough, for half a mile in approaching and passing by the station, cast iron standards and draw-posts are employed, the effect of which is remarkably light and elegant, a line of six wires is there completed, and in crossing over a carriage shed immediately opposite to the station, the wires are stretched over a length of 138 feet without any intermediate support, and so accurately are they arranged that no difference is perceivable in their parallelism the draw posts in this instance are half a mile apart, although the line is slightly curved In passing over a station or an accommodation road, or in crossing the railway loftier standards are employed, which abruptly lift the wires to the height of 25 or 30 feet in order to clear objects passing below In the latter case lighter wires are employed, that the tension out of the direct line of strain may not draw the standard from the perpendicular

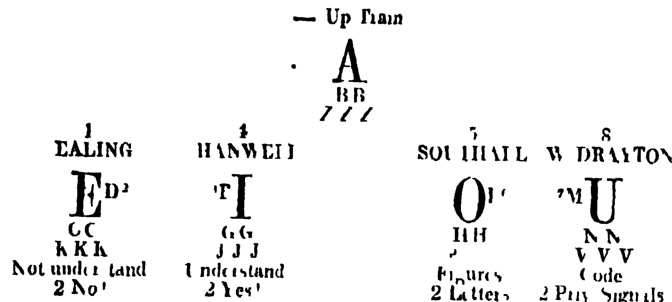
The last advantage which need be noticed in connexion with this very important step in the invention, arises from the very perfect insulation from the earth This allows of the employment of the earth as half of the conducting circuit, without risk of the current finding a shorter course through some imperfectly insulated point For nearly two years Mr Cooke has tried this plan successfully on the Blackway Railway, and since on the Manchester and Leeds Railway, but where, as in these instances, the wires are enclosed in an iron pipe, there is always danger of a contact either partial, from a few drops of moisture, or perfect, from the metals of the wire and pipe touching, in which case, as before observed, the electricity takes a short course instead of performing its entire circuit, and no signal is given at the distant terminus, though appearing very strong at the point whence it sets out With the wires suspended in the air no such danger exists, whilst two advantages spring from the employment of the earth as a conductor. 1st, one wire is saved in each circuit, thus diminishing complexity and cost, and 2nd, the earth acting as a great reservoir of electricity, or as some think as an excellent conductor, the resistance offered to the transmission of the electricity is vastly diminished, and the battery is able to work through a much greater distance with a smaller conducting wire It is thus that the apparatus exhibited can be made to work with two wires only.

Mr Whishaw then explained the model of the telegraph Upon moving the handle the poles of the battery are immediately brought in contact with the extremities of two wires, one of which passes forward to make coils around the galvanometer frame, in which the magnetic needles are suspended, and then proceeding to the distant apparatus to make similar coils there;

the other branch goes in the manner I explained to the earth. Thus, supposing the electricity really to find its way through the earth, it enters the corresponding branch at the distant apparatus, and passes into the wire which makes coils around the magnets, returning to the battery by the conducting wire, and producing the same divergence of the magnetic needles in both galvanometers and indeed in as many, and wherever situated, as the electric fluid encounters in its course When the handle is in the position of repose, the ends of the conducting wire and branch wire to the earth, are always in contact, forming a bridge for the electricity to pass from one to the other, but when the handle is turned the bridge is broken, and the wires are pressed in contact with pins connected to the battery poles upon restoring the handle the battery is disconnected, and the bridge restored for the passage of the electricity from the other end. By reversing the movement of the handles the previous contacts with the battery are also reversed, the current passes in a contrary direction, and the needles change their deviation

The simple signals are given by the movements of the needles either singly or combined, if both converge upwards A is meant if downwards the stop. These signals are the same as in Professor Wheatstone's diagram, the remaining signals are additional The left hand needle moving to the left gives E to the right I, the other needle gives O and U, both pointing parallel W and Y The consonants most in use are given by two movements of the needles, and those very rarely required, such as J, Q, X, Z by three movements C is used for K

The following is a reduced diagram of the dial now in use upon the Great Western Railway, between Paddington and Slough It has been proved to be capable of giving the twenty six letters numbers and various conventional signals at the rate of thirty per minute, it is worked by two handles in the centre between the two needles



The Patent Street-cleansing Machine of which we gave a detailed view April number, has continued in daily operation in Regent- express themselves perfectly satisfied with its perform- -pect Westm see it generally introduced. A public company is now shall be truly so, the machine in the metropolis and its vicinity. but the arches v

METROPOLITAN BUILDING ACT.

We refrained last month from offering any opinion on the Bill now before the House of Commons, entitled "A Bill for the better regulating the Buildings of the Metropolitan Districts, and to provide for the drainage thereof," in consequence of not having had sufficient time to peruse it with that attention which such an important Bill requires. We have since carefully perused the whole of the Bill, and maturely considered it clause by clause, and we cannot do otherwise than at once pronounce it the most monstrous interference with public convenience and private rights, which was ever attempted by members of the English legislature, and if it be allowed to pass in its present state, we say fearlessly that it will be a disgrace to the architectural profession, for we understand that the Bill is the production of some half-dozen architects, to whom it was submitted to draw a new Bill to supersede the present Building Act.

This Bill appears to have been studiously framed to see how far the builder might be trammelled with expence, difficulties, fines and penalties, it not only contemplates enormous additional costs in the erection of buildings, but also taxes them with exorbitant fees to be paid to district surveyors, and a new fangled board to be called official referees, together with numerous other charges which we must submit in detail as we proceed with an analysis of the Bill We shall not follow the Bill exactly in the order as the clauses stand, for they do not appear to be properly connected, but must connect them in such a manner as appears most desirable for the purpose of a proper understanding of the Bill. The number of the clause we have placed at the commencement of the observations, and those words within parenthesis, in italics, we propose to introduce, instead of the words previous

1 The Bill proposes to extend the present district of the Building Act to the suburbs of the metropolis, and will comprise the following additional districts —Fulham, Kensington, Hampstead, Hornsey, Stoke Newington, Stratford, Poplar, and Bromley, in Middlesex, in Kent, Woolwich, Charlton, Greenwich, Deptford, Lee, Lewisham, and Plumstead, in Surrey, Wandsworth, Tooting, Streatham, Clapham, and Battersea.

119 The magistrates to appoint the new surveyors, as heretofore, but the surveyors must not be less than thirty years of age, the present district surveyors to retain their present appointments.

15. There are to be three official referees to be appointed by the Secretary of State for the Home Department, for the purpose of determining the questions directed to be referred to them, and the determination of any two of such referees shall be binding on all parties, and if the parties agree, may be referred to one of such referees only, whose decision shall be binding in all respects

It proposes to alter the present method of rating the size of the buildings, and instead of allowing the superficial contents of the building of dwelling houses, to regulate the rate, they are to be governed by the heights of the walls and the number of stories they contain, which part of the Bill, with some alteration, will be far superior to the present absurd system of ascertaining the rate by the plan.

5 and 6 There are to be eight rates of buildings, and the floors of all buildings are to be counted from the foundation inclusively, but exclusively of the rooms in the roof (if any), and the height, except in 5th and 7th rates, shall be measured from the surface of the lowest or first floor to the top of the wall or parapet of any one of the fronts thereof

Here we must decidedly object to the rooms in the roofs of dwelling houses being excluded in the clauses, as it will keep up the present very equivocal mode of building by introducing curb roofs, which are nothing more than an evasion of the present Act. We therefore propose that the rate of dwelling houses should include the rooms in the roof, and that an additional story, and a few feet in height, be added to each of the four following clauses, the alterations we propose are in italics.

7 First Rate —Dwellings containing more than four (*five*) floors, and fifty-seven (*sixty*) feet high and not seventy (*eighty*) feet, and other buildings, not dwellings higher than 40ft. and not 50ft.

8 Second Rate —Dwellings containing more than four (*five*) floors, and forty-seven (*fifty three*) feet high, and not fifty-seven (*sixty*) feet, and other buildings 30ft high and not 40ft

9 Third Rate —Dwellings containing three or four (*five*) floors, and thirty-three (*forty*) feet high, and under forty-seven (*fifty three*) feet, and also every dwelling of a lower height with more than three (*four*) floors, and other buildings higher than 22ft. and not exceeding 30ft.

10. Fourth Rate.—Dwellings not having more than three (*four*) floors, and less than thirty-three (*forty*) feet, and other buildings not higher than 22 ft

11. Fifth Rate.—Every building not a dwelling, brewery, distillery,

manufactory or warehouse, containing only one floor, and not exceeding 12ft. above the footings to the top of the wall.

It will be seen hereafter, in consequence of the additional thickness of the walls for fourth rate buildings to what they now are, that it will be a very serious detriment to the construction of small houses with only two stories, of which there are many thousands in the vicinity of London, and which we consider far better for the poorer inhabitants than having several families huddled together in one house containing numerous rooms; we therefore propose to meet this class of dwellings, and have them rated on the fifth class of buildings, for which purpose we propose to add to this clause the following words *Every dwelling house which shall not have more than two floors, and which shall not exceed the height of 20 feet.*

12 Sixth Rate.—Every building 20ft. from any street or alley and detached from any house, or building, or ground not in the same possession, 50ft. The walls or inclosures (except chimneys) may be built of any materials but if of brick or stone, shall be built according to their height of the thickness required for the five preceding rates.

13 Seventh Rate.—Every building for the purpose of trade or the collection of toll, detached, 15ft. from any other building and which does not cover more than 100ft. square of ground and is not higher than 12ft. from the ground to the highest point of the roof, may be inclosed with any materials except roof and chimney.

14 Eighth Rate.—"All churches, chapels and places of public worship theatres, exhibition-rooms, and other buildings whether included in the aforesaid rates or not used either solely or at stated period for purposes of public business instruction, debate, diversion or resort and also all breweries distilleries manufactories or warehouses which shall be more than 50ft. high, and also all dwelling houses which shall contain more than seven floors or seventy (*eighty*) feet high all such buildings to be built with party and external walls 4½ in. thicker, and when the carcase is built, the owner shall give 21 days' notice to the surveyor and to the official referees, who shall survey the said buildings and within 7 days certify their approval of the same, or in case any part shall appear defective or insufficient notice to be given in writing within 7 days to the owner who shall forthwith alter and strengthen such defective or insufficient parts and shall not cover up any such parts, until such surveyors and referees shall be satisfied.

128 And upon completion of such building, the owner, shall give 21 days notice to the surveyor, and such surveyor, together with the official referees shall survey the same, and shall certify that such building has been built to their satisfaction, and such certificate shall be immediately filed by the clerk of the peace, and then it shall be lawful to use such building and if used before the certificate is satisfied, the owner or occupier shall on conviction before two justices forfeit not less than five pounds nor exceeding five hundred pounds daily (!) until the filing of the record of such certificate. Provided always, that if within 20 days from the assessing of such penalty such certificate of satisfaction shall not have been filed as aforesaid such house or building shall be liable to be abated as a nuisance, under the powers in this act contained."—

	£	s.
(129.) The surveyor's fee for surveying such building in addition to a first rate fee	10	10
First rate fee	7	7
To each of the referees who shall have assisted in the supervision and signed the certificate £10 10s. (three referees)	31	10
	49	7

And it is doubtful whether the official referees could not claim a further fee, for clause 130, says—

"They shall in addition to the fees before mentioned have, and be entitled to, the following fees"

For every survey
For every certificate
For every award

the amount of the fees being at present left blank. We have now enumerated the leading features connected with this precious piece of legislature, regarding the eighth-rate of building, and we know not words strong enough to express our disapprobation of clauses most monstrous, whether we regard the exorbitant penalty of £500 a day, or the litigious spirit which breathes through all the clauses, or the extortionate fees which they propose. As clause fourteen now stands, it contemplates every school, literary institution, beer shop, public house, or tavern, all being places of public instruction, diversion or resort; banks, insurance offices, or in fact the offices of any joint-stock company, coming, it is to be supposed, under the class of buildings devoted to public business, are all to be classed within this rate of building; and it will be difficult to construe what is and what is not a building for public business. Although the district surveyor is appointed to inspect the works as they proceed, and stop them if they be not constructed to his satisfaction, yet when the building is covered in he has still, in conjunction with the referees, the power of ordering any part of the building to be taken down. If we are to have district surveyors, we must suppose them to be persons capable of performing their duties, and if so, why have the two special surveys directed to be made at the time of covering in the building, and when it is finished? The clause does not either compel the surveyor or referees to file their certificates with the clerk of the peace, and we cannot, therefore, think that any part of the clauses regarding the eighth rate of building will be allowed to remain in the bill, but be expunged *in toto*, as they ought to be, for the clauses of the rates and thicknesses of the walls is quite sufficient for all the purposes that the public have a right to expect for their protection; besides that, the proposed clause entails a delay of nearly, if not quite, two months in giving notice and waiting for the certificates. The effect of this delay in the case of a railway station will be palpable to our readers, very often entailing the postponement of the opening of the line until another season. As to the fee of 49*l*. 7*s*., what the church commissioners, the national school society, and the friends of education will say to it we scarcely know. 500*l*. is often the extent of the money which can be expended on a place of worship, school, or literary institution, and a tax of 10 per cent on this amount is to be imposed. Where the architect often is not paid, and always insufficiently, it is rather too bad that money should be wasted on surveyors.

16 Attached buildings to be separately rated and the external walls to be of the rate of which such attached building would be if not so attached, but so far as regards the party walls shall be held to be of the rate of the building of the highest rate *to which* such party walls *shall adjoin when such attached building shall be completed.*

This part relating to party walls is rather ambiguous we suggest, that those words in italics be omitted and that the words "*on either side of*" be introduced instead of "*to which*."

Thicknesses of Walls.—It must be recollected in reading over the number of the floors that the lowest floor of the building is reckoned the first floor, and in consequence of our proposal (see ante) that the rooms in the roofs of dwellings shall be counted we suggest that the party wall above the upper room floor of the first and second rate buildings need not be so thick as provided we have therefore given in *italics our propositions* and also an alteration for the thickness of the party walls of third rate buildings.

49 Footings of External and Party Walls.—Footings to be nine inches thicker than the walls above and four courses high and the top twelve (*six*) inches below the surface of the lowest floor, or six inches below the surface of the lowest ground.

50 First Rate external walls 1 ft. 10½ in. thick, from footings to underside of the fourth floor and 1 ft. 5 in. from thence to the top of the gutter plate and the remainder 8½ in.

51 and 52 Second and third rate external wall from footings to the underside of the second floor 1 ft. 5 in. thick and from thence to the gutter plate 13 in. and remainder 8½ in.

53 Fourth Rate external walls from footings to top of gutter plate (*of upper room floor*) 13 in. and remainder 8½ in.

54 Fifth Rate external walls to have 2 courses of footings and 1 ft. 6 in. and 1ft 1 in. thick and above the footings 8½ in. thick.

79 Party Walls of first or second rate from footing to the underside of the second floor 1 ft. 10½ in. thick and thence up to the top (*of the upper room floor*) of 1 ft. 5 in. (*and thence up to the top of such party wall 13 in.*) and the party wall of the third rate from footing to the underside of the fourth (*third*) floor 1 ft. 5 in. and from thence to the top 13 in.

80 Party walls of fourth and fifth rate to be 13 in. thick above the footings excepting in a warehouse of the fourth rate when it is to be 1 ft. 5 in. thick to the ceiling of the lowest floor.

81 and 82 Materials of External and Party Walls.—To these clauses we must call the special attention of our readers. They are to be built solid of good sound well-burnt bricks or good sound stone excepting such iron work as may be required for bonds and corbels, and excepting the ends of girders and bressummers or tiers of door cases to warehouses, and the frames of doors and windows in external walls, all of which shall be fixed at the distance of 4 in. from the external face of such wall and excepting such wood and iron work in the lowest or first floor and in the ground floor as may be required for bressummers girders and story posts and excepting in party walls, flues and such iron work as may be required to carry the ends of girders, bressummer trimming joists and principal timbers of roofs, and the ends of all such girders bressummers and other timbers (in party walls) shall be carried upon iron shoes or stone corbels built into the wall at least two thirds of the thickness thereof to receive them as shall also all trimming joists lying against such party wall. In another clause (47) it enacts that every girder or bressummer which shall have a bearing on a party wall shall be laid upon iron or stone templates 6 in. thick, and the end of every such girder or bressummer shall not be fixed into, and shall not have its bearing solely on the party wall, but shall be supported by a brick or stone pier, or iron column or timber story post, fixed on a solid foundation.

Now let us consider the serious effects of these two clauses, as they now stand, no place bricks can be used in any part, the consequence of which will be that the brick-makers will have great difficulty in disposing of them, and must therefore increase the price of stock bricks. We consequently suggest the insertion of the words in

clause 56 and 58, "place bricks may be used internally above the third floor of the first and second rate—and the second floor of the third, fourth, fifth and sixth rates of building." Neither can there be inserted into either party or external walls any timber for bond, lintels, plates, wood bricks, nor the ends of joists, or in fact any timber whatsoever, excepting as hereafter mentioned, the consequence is that the ends of joists, &c., must be notched on or framed into plates, and the plates must be carried by iron shoes or brackets, which will cause the plates to project into the rooms below the ceiling line, and it is a well known law that timbers which are fixed at their ends, as when let into walls, will bear double the weight, as when the ends are laid loosely on the bearings, as the case would be if the joists were laid on the plates, clear of the walls; nor are the plates so strong on brackets as when they are bedded into the walls, or the walls so securely tied in, we must therefore have an exception for the insertion of all necessary timber, for bond, plates, lintels, ends of joists, and wood bricks requisite to fix the joiner's work, but no such timber shall be inserted in the walls within four inches of the face of the wall, or within 12 inches of any flue, or inserted in any party wall more than five inches beyond the face, and by clause 47 above enumerated, for the purpose of supporting the ends of girders there must be a projection into the rooms under for the story posts or piers, which in dwelling houses will be a great eyesore.

65 and 66 CHIMNEYS.—No part of the chimney breast or stack will be allowed to overhang or oversail any lower part of the brickwork, either on the front or sides thereof, excepting a single chimney above the ceiling of the fifth floor of a first and eighth rate, or above the ceiling of the third floor of the second, third and fourth rates, and it is also provided that no jambs, breast, and back of any chimney, and the front back or with of every flue shall be built at least 8½ in thick, and all the insides rendered or pargetted

The effects of these two clauses will cause nearly the whole length and height of party walls to be at least three bricks thick, as the party wall on the upper story is generally filled with chimneys and flues, these clauses must be altered and a proviso inserted that chimneys shall not overhang more than 12 in. on the side in each story, and that the thickness of the flues be reduced to 1½ in, and also that they shall be rendered or pargetted both internally and *externally* where they are below the roof, the rendering them externally we consider a far safer mode against fire than the increased thickness

43, 44, 45, and 46 We have four clauses regulating the strength of timbers They enact that no joists rafters, or quarters, shall be more than twelve (*thirteen*) inches apart, and no joists have a longer bearing than 15ft nor any rafter or purlin more than 11 ft and that no girders shall be so laid that the joists bearing thereon shall be more than 12ft bearing It is then enacted that the joists shall be not less than the following scantling

bearing		Joists depth	Joists thick	Trimmers depth	Trimmers thick
6 ft to	8ft	6½	2	6	3
8	10	8	0	8	3½
10	12	9	2¼	9	3½
12	15	10	2½	10	4
Beams and Girders with a bearing					
9ft to	12 ft	9	6		
12	15	10	7		
15	18	11	8		
18	21	12	9		
21	24	13	10		

It is perfectly absurd to attempt to regulate the scantlings of timber, for there are such a variety of ways of framing timbers, and of combining them with iron, that it is impossible to meet all cases besides, as the above clauses now stand, iron could not be introduced, excepting the girder be the same scantling as provided above, for the clause says, no joist, beam, or girder, shall be of less scantling than the above. The same remarks apply to the regulations of the scantlings of the roof and partitions. We therefore consider that these clauses must be withdrawn.

36 to 42 Regulations respecting the drainage of houses The walls of any building must not be built higher than 10 feet before drains are properly built, and made good into the common sewer, if any within 100 ft. distance, into which it is lawful and practicable to drain or otherwise, into proper cesspools, so as to render such drains available for the drainage of the lowest floor, and the Commissioners of Sewers can also, upon giving one month's notice, compel every house already built and not drained, to construct proper drains.

These clauses respecting the drainage, had better be omitted until the pr[illegible]ed inquiry into the metropolitan sewers be concluded, and a [illegible]ght in for the regulation of the drainage and sewage of the me[illegible]olis, for as the clauses now stand, builders will be put to enormous charges, for constructing sewers as now compelled by some of the commissions, and the expense of draining a house into a sewer 100 ft. off may involve an expense of £100, for we conceive the sewer commissioners would not allow a small drain to be carried along under the streets, but compel the formation of a sewer which, in the Westminster division, will cost 1*l*. per foot for the second size (the smallest) sewer.

23 This clause enacts that, in any house already built, or which shall be hereafter built, it shall not be lawful to let separately except as a warehouse or storehouse, nor to occupy nor suffer to be occupied for hire as a *dwelling* place any room containing less than one square, nor any underground cellar or room of any dimensions, unless every such room shall have a window in the same to an open area and fire-place with flue, and an open area adjoining to such underground cellar or room, under a penalty of twenty shillings per day, the said cellar or room shall be so occupied

25 No room less than eight feet high shall be used as a dwelling

We consider these clauses require some explanation, and the word *dwelling* defined, whether a kitchen below ground used for domestic purposes during the day is considered as a room used for a dwelling, or whether it means a room in which a person sleeps; if the latter, we then conceive it will be better to introduce the word *sleeping* place or room instead of *dwelling*. We also consider it a great hardship to prevent the use of any room for a dwelling less than one square, or say 10 ft square, or 12 ft. by 8 ft 4 in or 8 ft high, of which there are many hundreds in the metropolis This is carrying the provision for health rather too far, and will very considerably increase the expences of the poor for rent. If the word dwelling is construed so as to include a kitchen, then nearly every shop in London will have the basement rendered useless.

20 Hereafter no street shall be of a less width than 30 ft, nor alley less than 20 ft wide when such alley shall have *two* (*one*) open entrance thereto, at *opposite sides or ends at* least 20 ft wide, *nor of a less width than 30 ft. when only one entrance and which entrance shall be at least 30 ft wide* and the width of every street or alley shall be ascertained by measuring such width only as shall be given up to or used by the public

This clause will increase the ground rents of small houses, we recommend that all those words in italics be omitted, and that the measurement be taken between the fronts of the houses, otherwise it will materially prevent the formation of areas and fore courts, the latter we consider better in alleys than having the whole space paved, which will render the repairs more expensive to the parish.

27 It shall not be lawful to carry on in any building, or in the open air, at a less distance than 50 ft from any other building or ground not in the same possession, any trade or business such as that of a soap-boiler, tallow-melter, slaughterer of cattle or horses blood-boiler, bone boiler, fellmonger, oil cloth painter, manufacturer of gunpowder detonating powder, lucifer matches, or varnish, gas works, chemical works, fire works, *or any other trade or business which is or shall be considered by two justices to be dangerous as regards fire, or dangerous or offensive or obnoxious as regards all persons, more especially those persons living or passing in the vicinity thereof*, nevertheless it shall be lawful for all such trades as now established to be carried on in their present situation, for a term of 30 years—every person who shall be convicted before two justices of carrying on such dangerous or offensive trade, shall forfeit any sum not exceeding fifty pounds, as the said justices may determine

We pronounce this clause to be the most unconstitutional one which was ever submitted to the English parliament. Here we have the power of magistrates to determine what is an offensive business. Every baker, butcher, fishmonger, oil shop, and many other trades that perchance may be in the vicinity of any litigious person may, without notice, without summons, without a hearing, or without the power of appeal to a jury or to a quarter sessions, be ruined, their business stopped, and a fine inflicted of 50*l*. by two justices,—who may meet in their own private parlour, or in the house of some influential person who may demand their services, and expel any business which they think proper. That part of the clause given in italics must be omitted, and the other part altered.

We must now offer some observations regarding the magisterial clauses, the interpretation clause says —"Two justices of the peace shall mean two justices of the peace for the county within which the building or other subject matter is situate," it does not provide in any part of the Bill that they shall be in petty sessions assembled, which we consider most essential, otherwise cases may be heard at their own private dwellings, at any time and at any hour,—which we consider most objectionable, we would rather, that if the house be within the district of the metropolitan police offices, that the case should come before one of the stipendiary magistrates in the public police court; for here we have some responsibility, and a person by education brought up for judicial decisions, they will be called upon to adjudge upon severe fines and penalties, many of them are most enormous, but which no doubt will be altered. Nor is there provision that the parties committing an offence shall be first summoned

and heard in defence; we therefore direct special attention to all the penal clauses, for the purpose of correction.

We must also direct attention to the subject of notices, which in many cases it says shall be served upon the owners; now, who is to determine the owner, and if he is known and residing 200 miles from the metropolis or in the country, how is a notice to be served? We consider that, if the notice be served upon the occupier, or the receiver of the rents if residing in London, it should be quite sufficient.

There are many other most objectionable clauses compelling occupiers to do repairs, &c., how they are to be done by many poor inhabitants who cannot raise sufficient to buy a loaf, we cannot tell, it is true that they can deduct the amount from their rent, but many of the repairs and other works requisite to be done must be done instanter on the occasion, subject to heavy penalties—besides, where will they find builders that will undertake to do the repairs, &c. for these poor tenants, without first having the money paid down.

We must now direct attention to the fees to be claimed by the district surveyors, which are more than double those allowed by the present act, which are now maximum fees.

	New Buildings £	s	d
First Rate	[illegible]	7	0
Second "	6	6	0
Third "	[illegible]	5	0
Fourth "	4	1	0
Fifth "	2	2	0
Sixth "	6	6	0
Seventh "	0	10	6

And for every alteration or addition one half the above fees—and also if any addition, although carried up at the same time as the main building, is to be separately rated, according to the heights, and a fee paid upon it.

These fees must be reduced to one half, or the amount of the present fees inserted.

We have already directed attention to the fees for eighth rate buildings.

There is one other evil attendant upon this bill—which is, that should a party lose a cause, he is to be mulcted in double costs of suits, in one case treble costs—this is a denial of justice, it is quite sufficient to deter parties from bringing actions vexatiously to amerce them in the payment of single costs of suits, which are rarely less than £100, if not double that amount on both sides if he loses, we must therefore urge that these inflictions of double and treble costs be omitted, besides, who is to be entitled to these additional costs? are the lawyers the parties to benefit?

We have now directed the attention of our readers to the principal clauses in this Bill, and pointed out many serious objections; there are others which we cannot now find space for, but we shall consider it our duty to submit a copy of the Bill, with our remarks and proposed amendments, to the Noble Lord who has charge of it in the House of Commons, and we must urge upon the profession, to come forward and remove the objectionable parts, or it will be a stigma upon the profession, with whom it is said to have originated

STEAM NAVIGATION.

HER MAJESTY'S ROYAL STEAM YACHT "VICTORIA & ALBERT."

The launch of this singularly beautiful and magnificent steam vessel took place at Pembroke, on Wednesday 26th April The following are the principal dimension —

	Feet	inches
Length extreme ..	225	0
Length on the deck .	205	0
Length between perpendiculars	200	0
Length of keel for tonnage	181	2
Breadth outside paddle boxes	59	0
Breadth for tonnage	33	0
Breadth moulded	31	11
Depth in hold .	22	0

Burthen in tons, 1 049 She is divided into five water-tight compartments, and her engines by Messrs Maudslays & Field, are of 450 horse power

Her construction is entirely novel, and according to designs prepared by the Surveyor of the Navy, she is considered by competent judges to be superior, in point of beauty, buoyancy, and strength, to any other description of steam vessel ever produced in this country Some idea may be formed of the novel and peculiar style of her construction, as well as of her great strength, when it is stated that she is built only with plank, the first two layers being of oak 1¾ inches thick, placed across each other diagonally at an angle of 45 degrees, the outside plank being of larch three inches thick, lying longitudinally or with the sheer of the ship, and the whole being bound up with vertical and diagonal iron bands Between each layer of plank the surface is covered with thick tarred felt, the vessel therefore cannot leak, nor be in the least degree damp inside, and being divided into five compartments by four water-tight bulkheads extending as high as the state deck, it is impossible for the body ever to sink, although it might be bilged in any part from accident Her keel was laid on the 9th of November, 1842, the anniversary of the birth of His Royal Highness the Prince of Wales by Mr William Edye the master shipwright of the Royal Dockyard at Pembroke, and the greatest praise is due to Captain Superintendent Sir W O Pell, an officer of distinguished service and merit and to the respective authorities, for the skilful arrangements and extraordinary exertions made in building this ship in the winter months in the short period of only 23 weeks She would however have been completed in much less time and been ready for launching by the 1st of March but for the loss of a vessel with stores for her completion in her passage round from the eastward and the unavoidable detention of other vessels by the tempestuous weather in their voyage from the eastern dockyards to this port She was brought round from Pembroke to the river Thames and towed up the river to the East India Docks, Blackwall on the 5th ult and is now being fitted with her engines

The Screw Propeller.—*The Mermaid* (lately fitted with Messrs Rennie's Steam Propeller and by the same firm with engine and boilers) has made several experimental trips down the river in order to ascertain her speed which was found (at the measured mile Long Reach) to be equal to 12¾ miles per hour through the water after trying her at the measured mile, she was put alongside the *Red Rover* (Herne Bay Steamer) which is said to go 13 25 miles through the water but in running her from Long Reach Tavern to Gravesend (about 10 miles) the *Mermaid* gained about 300 yards on her opponent These experiments fully prove that the "Screw" is nearly equal, if not quite to the paddle wheels The engines of the *Mermaid* are of the nominal power of 45 horses each her immersed mid ship section about 48 ft. We may observe that the lines of the vessel are not what they should be for going 12¾ miles per hour, in fact when she was built (4 years since) she was not considered a fine form for speed

The Peiki Tijareti.—(The Precursor of Trade)—This fine vessel built for the Ottoman Steam Navigation Company, for the conveyance of the mail and passengers between Constantinople and Trebison, made an experimental trip down the River Thames from Blackwall to Gravesend, on Monday the 29th ult There were present the Turkish Ambassador and Consul the Egyptian Consul, and numerous distinguished foreigners, and a party of scientific gentlemen She is the seventh vessel built in England for this spirited company The vessel was constructed from the design of Messrs Rotherhithe and Co by Mr Fletcher, and fitted with engines by the celebrated firm of Messrs Miller Ravenshill and Co Her dimensions are, length between perpendicular 168 ft beam 26 ft 6 in depth of hold 16 ft 9 in and draft 10 ft 6 in burthen 568 tons o M She has a pair of beam engines of 90 horse power each and are a beautiful specimen of Messrs. Miller and Co's superior workmanship they worked with remarkable ease, and gave great satisfaction as well as the build of the vessel, to all parties on board Her performance at the "Measured mile" was equal to 11½ miles through the water, considering her immersed section, this was an excellent performance On the return of the vessel to Blackwall, the Company retired to the "Brunswick" where a sumptuous entertainment was provided which was attended by his Excellency the Turkish Ambassador, and the Consuls and other parties who were on board

The Screw Propeller.—We see by the Liverpool paper, that Messrs Mather Dixon and Grantham have been very successful with an iron vessel, the "Liverpool Screw" fitted with their patent improvements The screw is worked direct without the intervention of spur wheels by the aid of a steam engine and boiler on the locomotive principle consisting of two cylinders 13 in diameter and 18 in stroke and when light the screw makes about 85 revolutions per minute the pressure of the steam in the boiler is about 50 lbs, and is used expansively The vessel is 65 ft long 12 ft 6 in beam, and draft 3 ft 9 in the trials of her power in comparison with other vessels is said to be most satisfactory

MISCELLANEA.

Payne's Patent for preserving timber from the ravages of the dry rot, insects, &c is now likely to be brought into extensive operation, the process consists of impregnating timber with a solution of the sulphate of iron, and afterwards with the muriate of lime which combines with the iron and forms an insoluble chemical preservative and by the process adopted, impregnates the timber to the very centre this is effected by placing the timber in large iron tanks with the solutions, and then first exhausting the air, and afterwards readmitting it, and then using a force pump with a pressure of 200 lbs on the square inch, to force the solution into the heart of the wood which it does very effectively Iron, as a preservative to timber, has long been known and it is now, through the ingenious process adopted by Mr Payne, likely to become very extensively adopted The Company is now preparing the timber to be used at Claremont, for the royal stables, by command of the government

A Congregational Chapel, at Derby, was opened on Wednesday, April 12th, designed by Mr Stevens, architect, of Derby The general plan is an oblong parallelogram, with a Tetrastyle Corinthian Portico at the entrance

front, and a deep recess at the opposite extremity. It is elevated upon a stylobate, which affords a sufficient height for School and Class rooms under the whole area. The Portico is approached in its whole extent by a flight of nine steps; the columns are 2 ft. 10 inches diameter at the base, and the Eustyle intercolumniation is adopted [illegible] eleven feet [illegible] is connected with the end of the building by square pillars, with corresponding antae at the four angles of the building. The [illegible] are brought out to the face of the antae, and have each five large semicircular headed windows with archivolts springing from [illegible] imposts. The whole entablature of the order is continued round the building. A large arch under the portico leads into a recess which affords access on each side to the School rooms [illegible] and Chapel. The entrances to the Schools are [illegible] by the [illegible] balustrade. The Chapel is 70 feet long, 15 feet wide, and 42 feet high, including the lobbies and entrance recess, over which [illegible]. The recess is filled by a Vestry and gallery over, which is [illegible] the body of the Chapel by a [illegible] elliptical arch springing from [illegible]. The Chapel is calculated to seat 700 persons, and admits of the [illegible] being increased hereafter by an extension of the end gallery [illegible] [illegible] other galleries on the side.

Liebig's Compost Manure. — This distinguished chemist [illegible] following description for preparing a compost manure, which is adapted [illegible] the inorganic matters to which [illegible] mixing equal parts of lime [illegible] potash (known as *salt [illegible] glass* in commerce) [illegible] and then adding ten or twelve parts of gypsum with [illegible] common salt. Such a compost would [illegible] the [illegible] which act by their inorganic ingredients. The silicate of potash employed in the preparation of the compost, must [illegible] to the [illegible] must give [illegible] the water in which it is dissolved, and dry to a white powder by exposure. It is only attractive of moisture when an excess of potash is present, which [illegible] upon the tender roots of plants. In those cases where [illegible] cannot be procured [illegible] will supply its place.

Birmingham Canal Navigations. — The Bentley Canal, which has [illegible] been executed by this company, under the direction of their engineer (Messrs. Walker and Burgess), was opened for traffic on the 28th of April. It connects the summit level of the Wyrley and Essington Canal near Wednesfield, with the Walsall or lower level of the Birmingham Canal near Darlaston, and both shortens the distance from the Walsall [illegible] to Wolverhampton, and opens up the [illegible] about Willenhall and Bentley. Although the weather was unfavourable, a considerable number of the committee and principal officers of the company were present, R. Scott, Esq., M.P., acting as chairman *pro tem.* In proceeding along the line in the company's pleasure boat the committee complimented Mr. Walker on the excellence of the work done by the contractors, and expressed much satisfaction at the quickness and at the same time, the steadiness with which the boat rose in the locks. The total distance between the two canals [illegible] nearly 3? miles, and 10 locks [illegible] in each [illegible] was performed by two horses in 57 minutes, the time occupied in passing through each lock having only been 35 seconds. The advantages of speed and steadiness combined in working the locks [illegible] making large paddles with improved machinery, and by introducing the water through culverts extending under the side walls for their entire length [illegible] having a number of long shallow openings into the locks.

Iron Ships. — The Iron Queen. — We [illegible] that iron is a material for shipbuilding is fast gaining ground. [illegible] steamers it has been a favourite [illegible] some time past, and there is not [illegible] wooden steamer building at this port, while we observe there are two [illegible] of the first class nearly completed, and we understand [illegible] for the building of three more. We are also now satisfied that the only objection [illegible] vessel of iron — namely the fouling during a foreign voyage — is completely removed. This is proved by the result of two voyages by the *Iron Queen*. This barque of 350 on register left the river [illegible] February, 1842, with [illegible] tons of coals for [illegible] whence she went to Mobile [illegible] for [illegible] [illegible] she has now completed [illegible]

[illegible] foulness was on her bottom. This desirable result is [illegible] by the [illegible] application of a compound of tallow, bright varnish [illegible] brimstone which effectually destroys marine vegetable and animal substances.—*Liverpool [illegible]*

THE VARIATION OF THE COMPASS.

Observations made at the Royal Observatory, Greenwich,

G. B. Airy, Astronomer Royal.

Mean Magnetic		Declination	Dip at 9 A. M.	Dip at 3 P. M.
1843	January	23 11 31	68 59	68 59½
"	February	23 9 56	68 59¾	68 59½
	March	23 7 17	68 58½	69 1¼
	April	23 4 48	69	69 0¾

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM APRIL 29, TO MAY 27, 1843.

Six Months allowed for Enrolment, unless otherwise expressed.

James Stewart, of 3, Gloucester-crescent, Saint Pancras, pianoforte-maker, and Thomas Lambert, of 91, Albany-street, Saint Pancras, pianoforte-maker, for "*improvements in the action of pianofortes.*"—Sealed April 29.

Moses Poole, of Lincoln's Inn, gentleman, for "*improvements in making decoctions of coffee and other matters.*" (Being a communication.)—April 29.

James Heyford, of Great Bolton, Lancaster, millwright, for "*improvements in the manufacture of certain bowls and rolls.*"—May 2.

Josiah Longmore, of Regent-street, Kennington, silversmith, for "*improvements in pens, pen holders, and pencil cases, part of which improvements are applicable to other useful purposes.*"—May 4.

Edward Morewood, of Thornbridge, Derby, merchant, and George Rogers, of Chelsea, gentleman, for "*improved processes for coating metals.*"—May 4.

Francis Dinnell, of Camborne, Cornwall, assay master and analytical chemist, and Henry Hutchinson, of Roswarne, in the same county, esquire, for "*certain tools of obtaining or manufacturing zinc from a substance or substances not hitherto made use of for that purpose.*"—May 4.

John Turnbull, of Holywell Mount, Shoreditch, [illegible] maker, for "*improvements [illegible] manufacture of horse hoes.*"—May 6.

James Roose, of Wednesbury, Stafford, for "*an improvement or improvements in the mode or method of manufacturing welded iron tubes.*"—May 9, two months.

William Edward Newton, of Chancery-lane, civil engineer, for "*improvements in the construction of boxes for the axles or axle-trees of locomotive engines and carriages, and for the bearings or journals of machinery in general, and also improvements in oiling or lubricating the same.*" (A communication.)—May 13.

John Tuppin, of Fitzroy-square, gentleman, for "*improvements in machinery for preparing and spinning hemp and such other fibrous materials as the same is applicable to.*" (A communication.)—May 13.

Robert Alexander Kennedy, of Manchester, cotton spinner, for "*improvements in machinery for grinding and sharpening cards used in carding cotton or other fibrous material.*"—May 13.

John Lucena Ross Kettle, of Upper Seymour-street, Portman-square, esquire, and William Prosser, junior, of Shaftsbury-terrace, Pimlico, gentleman, for "*improvements in the construction of roads, and in carriages to run thereon.*"—May 16.

Joseph Burch, of the City-road, engineer and machinist, for "*improvements in machinery for printing on cotton, silk, woollen, paper, oil cloth, and other fabrics and materials, and certain apparatus to be used in preparing the moulds and casting surfaces for printing, and for certain modes of preparing surfaces previous to the design being delineated upon them.*"—May 16.

William Mills, of Foster-lane, glove manufacturer, for "*improvements in fastenings for gloves and other wearing apparel, and in the mode of attaching the same.*"—May 16.

John Thompson, of Albury, near Guildford, doctor of medicine, for "*improvements in bedsteads and couches for invalids.*"—May 16.

Joseph Mazzini, of King's-road, Chelsea, gentleman, for "*improvements in typographical printing, combining the advantages of moveable types with the stereotype process by substituting for distribution a special font for each new work, by means of a pneumatic machine for casting, and a uniplane machine for composing.*" (A communication.)—May 16.

John Winter Walter, of Stoke-under-Ham, Somerset, glove manufacturer, for "*improvements in the manufacture of gloves.*"—May 16.

Robert Walker, Jun., of Glasgow, merchant, for "*improvements in propelling ships and boats.*"—May 18.

Charles Maurice Elizée Sautter, of Austin-friars, London, gentleman, for "*improvements in the manufacture of borax.*"—May 22.

Christopher Nickels, of York-road, Lambeth, gentleman, for "*improvements in the manufacture of fabrics made by lace machinery.*"—May 22.

Alfred Poole, of Mornington-place, Camberwell New-road, for "*improvements in drying malt and grain.*"—May 25.

Moses Poole, of Lincoln's-inn, gentleman, for "*improvements in the deposition of certain metals, and in apparatus connected therewith.*" (A communication.)—May 25.

John Gillett, of Brailso, Warwick, farmer, for "*an improved machine or apparatus for cutting or boring ricks.*"—May 25.

John Bushby Gibson, of Nantwich, Chester, Esq., for "*improvements in the manufacture of salt.*"—May 25.

Elijah Galloway, of Seymour-street, Euston-square, civil engineer, for "*improvements in the machinery for propelling ships and other vessels.*"—May 25.

Alexander Bain, of 326, Oxford-street, mechanist, for "*improvements in producing and regulating electric currents, and improvements in electric time-pieces, and in electric printing and signal telegraphs.*"—May 27.

Richard Henry Bihlter, of Maze pond, Southwark, oil merchant, for "*improvements in filtering oils.*"—May 27; two months.

Arthur Hill, of the Slad Parsonage, near Stroud, Gloucester, clerk, for "*an improved shower bath.*"—May 27.

OSCILLATING MARINE ENGINE.

Patented by Mess[rs] Mathew Dixon & Grantham, Liverpool

Fig 1

Fig 2

Valves

Cylinder

Fig 3.

Crank

Valves

Cylinder

OSCILLATING MARINE ENGINE.

Patented by Messrs. Mather, Dixon & Grantham, of Liverpool.

(With an Engraving, Plate IX.)

We have given a drawing of a pair of marine engines, on a plan lately patented by Messrs. Mather, Dixon and Grantham, of Liverpool, for an improved method of driving screw propellers; and we shall endeavour in a future number to add another arrangement showing nearly the same form of engine, but suited to vessels having a deeper hold than is required for the engines we now present to our readers.

Fig. 1, shows the half-side elevation of the engines, with one air pump and condenser.

Fig. 2, shows the other half elevation, with the engine turned round, representing the side opposite to the air pumps.

Fig. 3, is a ground plan of the whole arrangement, the cylinder on one side being removed.

It will be readily understood that these engines have oscillating cylinders, placed at right angles and opposite to each other, the piston rods being each attached to one crank. In the annexed drawings the cylinders are represented as working downwards, the object of this evidently being to allow the propeller shaft to be placed near the bottom of the vessel.

The engines are constructed with a foundation plate to which are attached the side frames that carry the cylinders, the pedestal of the main shaft is attached to the bed plate having the condensers cast on it, a small counter shaft is employed to work a beam which gives motion to two air pumps, one gudgeon of the beam rests on one of the side frames of the cylinders, and the other is supported by a small standard rising up from the condensers. It is intended to have short stroked engines, and to work them faster than is usual in sea going steam vessels, but not faster than is now usual on the Thames. By this means we shall presently endeavour to show that high velocities may be obtained without employing multiplying gearing.

It is unnecessary to enter into a more detailed description, as in all minor points nothing new is contemplated, the proportions and mode of working, which is found favourable with engines driving paddle wheels, will be equally applicable to these engines, excepting that the makers prefer having two air pumps with a short stroke instead of one.

As the advantages which may be expected from the employment of the screw propeller are of very great importance, and as the plans, which we are now considering, seem likely to remove many of the obstacles which have hitherto impeded its progress, we shall not hesitate to present to our readers some additional particulars of the plans by which Messrs. Mather, Dixon and Grantham propose to carry their project into effect, as well as an account of what they have already effected in a small vessel built by them, which has for some months been at work on the Mersey. It is from these results that they have founded their calculations of what may be effected in vessels of large dimensions.

We gave a brief notice of this vessel in our last number, and are promised the particulars of some accurate experiments which it is intended shall be made with her. We need only now say that she has more than realised the expectations of the builders, and from their report it appears to be the most satisfactory trial yet made on the screw as a means of propelling vessels. The propeller employed was patented by Mr. Woodcroft, in 1830. We hope in another number to be able to give a description of this also.

The mode of constructing the screw, supporting the shaft, the apparatus for regulating the endward pressure of the shaft, and other details, will come under our notice as we proceed. All, in our opinion, being matters of deep interest and importance to those concerned in steam navigation, when on the eve, as we firmly believe, of a great improvement to this truly national question.

We will now only add a few remarks on the principal features of the improvements here proposed, to show that it will not be necessary to introduce any system of working that has not under other circumstances been advantageously applied before, although not in the same combination. From the results given by the "Liverpool screw," it is stated that the advantage over paddle wheels, is fully 25 per cent, when under the most favourable circumstances for the latter, but that in towing and in rough weather, the gain by the screw when applied, as now proposed, is found to be nearly 50 per cent. It is therefore presumed that for general purposes two-thirds the engine power only will be requisite for the screw, that is necessary in paddle-wheel vessels, to give a certain speed. It is also found that if the pitch of the screw is made 2½ times its diameter, a very reduced amount of slip varying from 5 to 10 per cent, will take place, and that it is probable for light vessels and high velocities the pitch may be made three times the diameter of the screw. It is also clearly established that no disadvantage results from placing the screw one-third out of water. The steering is not perceptibly injured by it, and the loss from slip not increased, and it is expected that instead of its being an objection, it will be found more convenient for ordinary practice than when the screw is entirely immersed. This point we shall discuss when we describe the construction of the screw itself.

THE AERIAL TRANSIT MACHINE.

Analysis of the projected Aerial Transit Machine, and of the principles involved in its construction and employment.

(Concluded from page 191.)

Throughout the preceding portions of this inquiry, which have appeared in succession in our last two numbers, our purpose having been to illustrate the operation of the parts, rather than to determine the efficiency of the whole, we have taken a view of the case simplified in a manner which, if it were the true one would, however apparently exaggerated the obligations, represent the object as nevertheless within the reach of art to accomplish, even with the means, be they ever so moderate, which the projector might have at his disposal. The unlimited declension of the force by which the machine, regarded as a mathematical plane (incapable of generating any resistance but that which belongs to it *as such*) would be opposed in its horizontal progress, in a degree proportioned to the angle of its inclination, would, however remote, still indicate a point at which this obstacle would have been so far reduced that any power, however feeble, would be adequate to the accomplishment of the *rate* necessary to produce the desired result. In theory it is perfectly true that a *mathematical plane* of any proportion of weight and dimensions hypothetically assignable, could, by the exercise of *any* amount of propulsive energy (sufficient to overcome the *friction* of the parts) be made capable of sustaining itself in the air; a rate of motion equivalent to the production of a vertical resistance adequate to its support being as surely attainable at some angle of inclination, as any effect is surely consequent upon its cause where there is no force in operation to prevent it. But the difficulty of the matter lies here—the machine is not a *mathematical* plane, nor by any mode of construction could ever be rendered so, and the interference of its *solid* parts, in the resistance they experience in the air, however restricted by the contrivances of art, introduces a new ingredient of opposition, which, not following the same rule of reduction, but on the contrary, increasing with the process by which the former is nullified or avoided, puts a limit to the extent to which that process with its attending advantages may be carried, and thus removes the case out of the category of results *necessarily* attainable by the exercise of art. Before, therefore, anything can be positively concluded with respect to the success of any particular scheme of flight upon the principle of the plan before us, we must be satisfied that a *power* is at command competent to the production of a velocity equivalent to the support of the machine, restricted by this new element of resistance—the interference of its solid parts.

IV. And this brings us to the consideration of the *fourth* subject of our inquiry; namely, the *power of steam* which Mr. Henson purposes to employ for the occasion. It is not our intention in this analysis to enter into any examination of the particular construction of machinery by means of which Mr. Henson has sought to apply this power to this present object. This has been sufficiently largely done in other publications, as well as, more particularly, in the specification of his plans drawn up under his own authority. Upon this point we would merely observe that the main difficulty, to the removal of which Mr. Henson's efforts have been principally directed, is the reduction of the weight of the engine in relation to its effective force. In all modes of developing *power*, the nature of the process imposes upon the machinery by which it is elicited a certain degree of weight proportioned to the force produced Wherever there is a tension or pressure, there must be of necessity a counter-pressure or resistance in the parts of the generating apparatus, resistance cannot be experienced without strength of material, and strength of material cannot be had indefinitely without weight and it is in the relative reduction of this weight that Mr. Henson's ingenuity is presumed chiefly to display itself.[1] Whether this has been done successfully, that is to the extent claimed, consistently with the retention of the necessary degree of strength, it is impossible for any one to determine apart from actual experiment. According to the published accounts, Mr Henson's engine has been constructed to produce a resistance equal to the power of ten (some say twenty) horses, within the limits of 600 lb. weight. If this be true, he has certainly accomplished a very considerable abatement of that which has hitherto constituted a main obstacle to the establishment of a successful aerial navigation, and taking it for granted that such is the case, our intention here is to deal with the question upon these premises, and endeavour to test the applicability of the power so claimed to the purpose for which it has been designed.

We have said that a solid body cannot be moved through the air without experiencing a certain amount of resistance Now this resistance has been determined to follow the ratio of the squares of the velocities under which it is generated, and a table has been constructed upon experimental data, in which the effects of this force upon a given extent of plane surface perpendicularly impinged upon, are set forth in terms corresponding to different assigned rates of motion, varying from one to one hundred miles an hour, with, of course, a power of extending the scale indefinitely, subject, however, to a consideration which we shall disregard at present, but which if taken into account would only magnify the exigencies of the case which we are endeavouring to define, namely, that at high rates of motion, this resistance increases even more rapidly than the ratio of the squares of the velocities otherwise assigned Without regard to this qualification, however, we are enabled to ascertain that, at the rate of 240 miles an hour, prescribed to the machine as necessary to its support at an angle of 3 of inclination in the suspending plane, every square foot of plane surface perpendicularly directed, or *equivalent* amount of *oblique* surface, would experience an opposition equal to a force of 288 lb. avoirdupois; so that if we can conceive such a machine constructed so as to present to the impact of the air no larger extent of surface than what would be equal to 10 square feet perpendicularly exposed, the aggregate resistance it would experience to its progress at the rate in question, would amount to 2880 lb. + the horizontal resistance belonging to the plane *as such*, and which we have stated in round numbers to be, for that rate and degree of obliquity, about 150 lb.[2] Unless therefore the *power* at command be adequate to the development of a reaction equal to this resistance, the machine could not be impelled at the rate with the angle prescribed; and we should be driven to adopt either a *slower* rate of motion at the expense of an increased angle of inclination, and of the increased horizontal resistance by which the plane itself, at that increased angle would be encountered, or else a more *rapid* rate of motion due to a reduced angle of inclination, at the cost of the increased resistance due to the solid proportions of the machine with this additional impulse—whichever should be found to be productive of the least amount, in the aggregate of this resistance.

To apply this with mathematical accuracy to the illustration of the case before us, is clearly impossible, because we are entirely unprovided with anything like a proximate definition of the main force to be overcome, namely, the capacity of the solid parts of the machine for effecting resistance. In assigning 10 square feet we have no doubt that we are keeping far within the limits of the truth; and were we to assign a higher figure we might be met by a denial of our premises which no reasoning apart from actual admeasurement, and that of the most complicated description, could enable us to dispose of Fortunately, however, for the purpose of our investigations, we are not put to such an alternative, as we shall readily see that the exigencies of the case, even upon the mildest hypothesis, are so far beyond the means appointed to satisfy them, that there will be no occasion to suspend our reasoning upon so disputable a point as the correct estimate of the resisting surface of the machine

In order, however, to be able more satisfactorily to elucidate this position, it will be necessary to take into account the elements of the force we are considering in relation to the process by which it is purposed to be developed In estimating the actual amount of any force generated or required, it is well-known that, equally with the weight to be moved or the resistance to be overcome,[3] is comprised in the constitution of the force the *velocity* of or under which this result is to be accomplished. Without regard to this condition it is as impossible to give an intelligible definition of any force as it is for the force itself to exist or be exercised. A body cannot be moved unless it is moved through some space, and as every operation occupies some time, the time in which through a given space, or the space through which in a given time, the body is to be moved, are as essential ingredients in the constitution and definition of the force employed as the weight or resistance of the body which is the object of its application Thus it is clear that before anything can be predicted with distinctness as to the actual value of any force in action, or the adequacy of any contemplated power, the rate under which it will have to be exercised must be included in the terms of the proposition. In taking therefore the resistance which a given plane is calculated to develop in opposition to its course at a given rate, as the measure of the force which is required to produce it, the rate must be specified, not of the body so moved, but of the instruments of its propulsion, by the operation of which that resistance is to be called forth, and the reduction of this *rate* becomes exactly as important an object in the economy of the forces employed, as the reduction of the actual *resistance*, to the constitution of which it contributes Now the minimum rate of action that could be assignable to the *instruments* of a progressive motion is obviously that required to be conferred upon the machine itself, as the ultimate result of their operation; for, it is clear, by no appointment of surface, or other expedient, could the machine be propelled at a greater speed than that at which the agents of its propulsion were themselves accomplishing their reaction. Whether the conditions of surface, by which alone this conclusion

[1] The improvement of the machine in this particular does not merely regard the reduction of the weight of the engine itself but also of the means whereby its energy is maintained—the water and fuel necessary for its use In the modifications by which a saving of these may be effected, a further step is gained in the same direction, which, however, more properly concerns the question of the *duration* of the flight when it shall have been accomplished, than its abstract *possibility*.

[2] These numbers are not strictly correct They should have been stated at 228 miles an hour for the rate, with an horizontal resistance equal to 157 lb., as subsequently represented in table. The difference arises, partly from the omission of the cosine of the lesser angle in determining its proportion of vertical resistance, and partly from the adoption of a rate in round numbers, 12 miles an hour, as that at which a plane surface generates a resistance by perpendicular impact equal to two-thirds of a pound to the square foot, instead of 11·666, which is its true denomination. The results in the table further on are all based upon the actual quantities, and are mathematically exact

[3] It seems scarcely necessary to observe that in mechanical operations a *resistance* to be encountered is the same thing with a *weight* to be raised; the rate of development in the one case being exactly analogous to the rate of elevation in the other.

would be rendered attainable, have been observed in the appointment of the propelling apparatus in Mr. Henson's machine, we shall not stop to inquire, (though from a consideration of their apparent dimensions and the angle of their impact, we should conclude most assuredly otherwise;)[4] but, giving them full credit for their competency to that effect, proceed to show that even so, with a measure of resistance the least assignable, and a rate of impact the least under which it could be developed, the power in question would be utterly incompetent to enable the machine to maintain its elevation or continue its course, even for a single moment, at any angle of inclination at which it might be disposed. This we shall do by means of a table calculated for several angles of inclination, exhibiting at a view the several rates at which a machine of the proportions of weight and surface assigned to Mr. Henson's, would have to proceed at the corresponding angles of inclination, in order to generate a resistance opposed to gravity equal to the support of its weight, and the amount of horizontal resistance it would experience (considered as a mere plane) at each degree of the scale so impelled, expressed in pounds avoirdupois. In another column is shown the resistance which the solid parts of the machine would develop at the corresponding rates, supposing them to be so contrived as to expose an extent of surface not more than equivalent to a plane of *one* square foot perpendicularly impinged upon. In the next column are given the products of these last two quantities multiplied by the velocity assigned in miles per hour, representing the actual forces developed, reduced to the same standard, and consequently, the proper measure of the *power* commensurate with such results. The last column contains the expression of this force in *horse-power*, or the number of horses which it would take to answer this demand, according to the conventional mode of calculating the force of steam, that is, reckoning the power of a horse to be equal to a resistance of 32000 lb. at the rate of one foot in a minute, or 363 lb. at the rate of one mile per hour.

Obliquity of plane	Velocity in miles per hour	Horizontal resistance to plane	Ditto extra for one square ft	Total ditto reduced to a common standard	Equivalent horse power
0	40103 000	872	7912592 00	317 1871[illegible] 00	8741[illegible]6213 00
1	618 600	2557	2199 30	1 0 1[illegible]7 956	4147 37
2	534 132	101 707	550 27	21[illegible]268	[illegible]
3	253 089	157 2[illegible]0	244 [illegible]	[illegible]08[illegible]	247 03
4	167 463	209 769	137 [illegible]	[illegible]35 410	160 12
5	131 121	202 161	88 50	1[illegible]1 240	[illegible]
10	[illegible]7[illegible]0	528 936	22 54	37[illegible]1[illegible]	102 81
15	45 692	804 812	10 36	37101[illegible]	103 06
20	35 187	1091 932	6 09	38636 100	1[illegible] 43
25	28 996	1398 815	4 15	10680 663	112 66
30	25 071	1731 924	3 18	43500 792	119 83
35	22 473	2100 [illegible]58	2 46	47263 820	130 20
40	20 736	2517 180	2 11	5[illegible]239 997	143 [illegible]1
45	19 621	3000 266	1 89	58905 30[illegible]	162 27
50	18 996	3575 592	1 77	[illegible]79[illegible]5 6	187 20
54 46	18 804	4247 429	1 73	7[illegible]01 18	220 11
60	19 050	5195 784	1 78	99013 5[illegible]	272 76
70	21 223	8238·362	2 21	174859[illegible]	[illegible]81 [illegible]
80	28 451	17017 921	[illegible]7	48391[illegible]383	[illegible]53 19
85	39 679	34310 433	7 74	1[illegible]1710 786	[illegible]71 27
89 59	684 000	10313149 000	2301 85	7055706381 000	19437378 00

Upon reference to this table it will be seen that the conditions of flight which, under the circumstances prescribed, would be attainable with the least expenditure of power, are those which attach to an inclination of about 10 degrees; and for this a force would be requisite, equal to the power of above 100 horses. At any other angle of inclination, a greater amount of horizontal resistance in the aggregate would be experienced, and the requirements of power be proportionately enhanced.[5]

V. Now it is to be observed that the opposition which is here set forth as the measure of the propulsive power of the machine, is not a force only concerned in the initiation of its motion, which might be expected to vanish or become less influential after its first efforts had been subdued, like the passive resistance of mere weight, the *vis inertiæ*, or the resistance of adhesion, which when once suspended or overcome ceases to affect, but a force always in operation, always the same under the same conditions, and requiring always the same amount of power to compete with while it endures. And with this observation we might have been content to let the matter rest, as incontrovertibly determined, were it not that a principle has been set up, implied in the proposition of a certain contrivance, which strikes at the very root of our conclusions, and, were it correctly conceived, would equally invalidate any inference that might be deduced in derogation of the scheme, from the consideration of any deficiency of power, however extravagant, that might be alleged against it. Sensible of the inadequacy of their means, in the abstract, to the whole effect which it is intended to produce, and under the impression that this deficiency might be supplied by the intervention of a force not inherent in the means themselves, a part of their plan, upon which the greatest reliance has been placed, which has been put forward with the greatest pretensions, and which has elicited the greatest share of the public admiration and approval, is to invest the machine at its first starting with a certain amount of velocity or momentum, by means of a preliminary descent down an inclined plane, which, however unable to originate, its inherent power, it is expected, will be sufficient to maintain And this obliges us to devote a few lines to the consideration of the principle involved in this contrivance, which is the *fifth* and last point to which in the outset we proposed to direct our inquiries.

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[4] Supposing the propelling agents to be able by their rotation at a given rate to generate a given amount of resistance, the machine being at rest, when motion is conferred upon it, the condition of the medium, as far as the instruments of its propulsion are concerned, being altered by the consequent abstraction of the air, they would no longer operate with the same effect at the same rate of impact, but must either be worked with additional speed to enable them to overtake the retiring particles, or else proportionably increased in magnitude to enable them to take in a larger quantity of them. It is to this relation between the superficial dimensions of the propelling agents and that of the effective opposing front of the machine, that we refer as governing the relation of their respective resistances to their respective rates of motion, and by the due appointment of which, (regard being had to their form and direction of impact,) an equality of resistance becomes assignable to an equality of rate when the machine is in actual progression.

[5] This table may be made available to determine the conditions of flight assignable to any machine upon the same principle whatever the proportion of its weight to the dimensions of its suspending plane, subject to the following considerations In the first place the velocity necessary to effectuate its support depending upon the *relative* and not the *actual* quantities, any weight may be assumed as a standard, and the modification necessary to maintain the proportion, referred to the size of the suspending plane. Let the case, therefore, be reduced to the standard of weight ascribed to Mr Henson's plane, namely 3000 lb, and the surface determined accordingly. Now as the resistance *ceteris paribus*, varies in the simple ratio of the areas of the impinging surfaces, and the squares of the rates of impact, the rates, *ceteris paribus*, must vary inversely as the square roots of the areas. If, therefore, the velocity assigned to any angle in the table above be multiplied by the square root of the area of Mr Henson's plane, the product divided by the square root of the newly assigned surface, will give the rate at which it must be propelled in order to effectuate its support, as by a common rule of three. The horizontal resistances, depending upon the *real* quantities, may be deduced in like manner from those ascribed to Mr Henson's plane at the same angles, by simply substituting the new rate assigned, in the ratio of the squares of the velocities, and the true surface in the simple ratio of the dimensions and thus all the conditions of flight depending upon these data may be ascertained For example if we suppose the suspending plane to be magnified to 10 times that of Mr Henson's affording an area of 45,000 instead of 4500 square feet within the limits of the same weight, the velocity necessary to its support at an angle of 10° would be $\frac{67\ 7 \times \sqrt{4500}}{\sqrt{45000}} = \frac{67\ 7 \times 67\ 082}{212\ 132} =$ 21 408 miles an hour The horizontal resistance in this case, the weight being the same, would stand as in the table, at the same angle of inclination, the rate of development diminishing exactly as the surface is increased If to this quantity be added the perpendicular resistance due to one square foot at the newly assigned rate = 2 254 lb., and the sum be multiplied by the rate in question, we shall have 11871 715 lb. as the representative of the whole resistance to be encountered, which, divided by 363, the power of a horse in steam at the same rate, gives upwards of 31 as the number of horses, or the measure of horse-power, which would be requisite to enable it to accomplish or maintain its elevation in the air.

Were it not that this principle and the mode by which it is intended to be applied, had got hold of the public mind by some of those fatalities, by which the most preposterous opinions occasionally get disseminated and established, we should not have held ourselves justified in administering a formal refutation to a position so exceedingly absurd, that reference to the first rudiments of the physical sciences is more than sufficient to overset. For what, after all, is the principle which this position is calculated to uphold? Simply, that a body can be sustained in motion against a given amount of opposition by a less degree of force than what is actually required to establish it. That this is a true statement of the principle which is involved in this hypothesis, and that it is utterly fallacious and insane, we trust we shall not be at much pains to demonstrate; and the mode we purpose to adopt with this view, is to examine the forces which are inherently concerned in the establishment of a given motion, and those concerned in its continuance, to show that a perfect equality exists between them, and consequently that nothing less than what is required for the former would satisfy the exigencies of the latter. These forces, by which the induction or continuance of motion in any degree or direction, are solely affected, are reducible to four heads, the attraction of gravitation, the *vis inertiæ* of matter, the friction of the parts in contact—and the resistance of the medium in which it is moved.

1. Of these forces, the first, assuredly, opposes no impediment to the induction of motion which it does not equally oppose to its continuation. Acting in one direction only, and (appreciably at least) with equal force in that direction at any elevation attainable by man, it is clear that whenever it interferes at all, it can never operate with less force in one than in another stage of the same proceeding. To initiate, therefore, or establish a given motion even in direct opposition to gravity, not a particle more force is exerted than is required for its continuance. In an *horizontal* direction, however, with which we are here more immediately concerned, the attraction of gravitation literally interposes no obstacle whatever either to the induction or perpetuation of motion to any extent in any body, however ponderous and inert. This might, indeed, have been concluded, without reference to principles, from a simple consideration of its effects; as in a vertical or upright direction gravity *opposes* the induction of motion with its *whole* power, and in a contrary or descending direction it *favours* the same in exactly the *same* degree, so in a direction which partakes of neither, but is intermediate between both, it follows as a matter of course, it can really exercise no influence at all. The weight of a body has in fact nothing to do with the difficulty of imparting to it an horizontal motion, except in so far as it increases the friction, in regard to the medium of its support; a property which, as the weight is not altered by its translation, it must exert with equal efficacy in the ultimate as in the preliminary stages of its progression. So far, therefore, as the attraction of gravitation is concerned, it is certain that the exigencies of the aerial machine in respect of power, are not a whit less for the *maintenance* than the *establishment* of the motion which is sought to be conferred upon it.

2. With regard to the second of the forces enumerated, the *vis inertiæ* literally opposes, of itself, no *definite* obstacle to the induction or continuation of motion in any direction whatsoever, and literally requires no *definite* amount of power to overcome. Every body which is pressed against by another must reciprocate the pressure, and, unless restrained by some extrinsic impediment, must participate in the motion which is the measure of the force applied; the only condition affecting the establishment of a *given* rate of motion, so far as this property is concerned, being that a certain *time* must elapse before the operation be completed. In all transitions from quiescence to motion, or from motion to repose, a certain *time* is due to the transaction in respect [illegible] proportionate to the quantity of matter which is the subject of the change, and the only obligation which is imposed upon the [illegible] employed, so far as regards the *vis inertiæ*, is that it be [illegible] applied. With this reservation, there is no limit to the [illegible] can be produced, however great the mass to be moved, [illegible] the force employed to move it. A fly attached by a human hair to a ton of marble, would not only invest it with motion in an horizontal direction, if it were possible to suspend it free from all friction, but, presuming the absence of atmospheric resistance, bring it up, by continuous effort, to any rate of motion at which it could itself proceed; nay, the mighty globe of the earth could be propelled round the universe by an infant as fast as its legs could carry it, if it could find a path to walk on, provided the pressure was continued a sufficient time to allow all the particles to be indued with motion at the rate required. These results in relation to the hypothesis involved in Mr. Henson's scheme, may be conveniently and familiarly illustrated by the case of a man towing a heavily laden barge in still water, where the counteracting forces, friction and the resistance of the medium, being inconsiderably assignable, and the impulse in an horizontal direction, the *vis inertiæ* is free to display its peculiarities without ambiguity or interference. Here is no question as to whether the strength of the individual be sufficient to enable him to set his load in motion, or bring it up to that rate in which his own powers shall be equal to the extrinsic forces developed in the operation. As soon as he begins to pull, the boat begins to move, slowly at first, and increasing gradually until it reaches that point at which the friction and resistance it develops is equal to the power he is able to employ; nor would he accomplish anything by obtaining additional assistance in the commencement, which he would not immediately forfeit by its discontinuance, except a more speedy attainment of the same result. No one, not even the most unintellectual of bargemen, ever dreamt of being able at any time to drag his boat at a greater rate than he could, by his own unaided efforts, have brought it up to, or with less difficulty at the same rate, because he happened to have had the assistance of a friend to enable him to begin. And yet these are only the conclusions which the adoption of Mr. Henson's hypothesis requires us to admit. All, in fact, that the mediation of any extrinsic temporary force can effect, is to dispense with a part of the *time* that would otherwise be required to produce the result due to the inferior power alone; and it is to the former limitation of this element of invested motion that are to be ascribed those appearances in certain familiar cases which have been so triumphantly referred to as affording illustrations and attesting the correctness of the hypothesis upon which Mr Henson's scheme and the hopes of his friends are founded. The circumstances of the horse straining to drag into motion a heavily laden cart, which he afterwards appears to draw with the utmost facility, of the railway train and steam vessel, with so much difficulty seemingly set agoing, and ultimately proceeding with so much apparent ease, together with others of the like description, are all owing to the neglect of this consideration in the attempt to invest large bodies with motion at a given rate, in less time than is due to the proportion between their masses and the forces employed to move them. The conclusions, therefore, which have been drawn from these premises are utterly fallacious. Not a particle, absolutely, more power is required to initiate or establish a given rate of motion in any body than is requisite to compete with the extrinsic forces, the friction and resistance, developed at the rate in question, neither in the beginning, nor subsequently at any stage of the proceeding, there being anything *over* to be accounted for on the score of, or by which to measure the effects of, the *vis inertiæ* in respect of the motion so superinduced and established—a certain proof that, so far as this also of the forces enumerated is concerned, no more power would be required to produce, and, therefore, no less would suffice to maintain, the rate of motion assigned to the aerial machine as necessary to its support, than what is due to the *extrinsic* forces, the resistance and friction, developed at the rate required.

3. Now the friction, it is well known, is a force in no way affected by the rate under which it is developed; but is just as great in a state of quiescence, however strange this may appear, as under the extremest condition of velocity. So far, therefore, as regards the question before us, this may be considered as a neutral element; interposing no more obstruction to the establishment of a given motion than to its continuance, and requiring, therefore, exactly as much power to keep in subjection, if we may so speak, as originally to subdue.

[illegible]

4. But if friction be a force which does not regard the condition of motion, such is not the case with the resistance of the medium, which yet remains to be noticed. Unfortunately, however, for Mr. Henson's hypothesis, this force really pursues a directly opposite progression, being absolutely none or of no effect in the first induction of motion, and increasing in intensity and requirement of power in proportion as it is more fully developed. It needs no laboured comment, therefore, to point out how little colour the consideration of this force is calculated to give to the principle which Mr. Henson's contrivance is intended to set up. And this completes the list of all those elements of opposition which are called into play in the process of investing a body with a given rate of motion. There are, it is true, other forces, or as they may be more properly termed, accidental conditions, by which a body may be detained at rest against the exercise of a greater power than would be competent to continue it in motion after they had been overcome. If a cart heavily laden, for instance, be left standing for some time upon an imperfectly hard foundation, the wheels will create for themselves a *rut* out of which they will require to be extracted with a degree of force, the necessity for which is then immediately dispensed with; or if it has to be dragged over such a kind of road, the retardation of its course affected by the depression of its wheels, which is greater the slower the rate, indicates the necessity for an accession of force to bring it up to a rate of motion in which this condition is overcome, when it may, without prejudice, be discontinued. Again, an object may be so circumstanced as not to be able to exercise its means of propulsion to equal advantage in the beginning as in the subsequent stages of its progress, and may therefore require the employment of a greater degree of power to *acquire* than to *maintain* its destined condition of velocity, as exemplified in the case of the larger birds labouring to ascend from the ground, where the height of their bodies not permitting the full action of their wings, they are obliged to make up the deficiency by the more forcible and frequent repetition of the stroke, producing that appearance of disproportionate exertion which has contributed to maintain, if not to suggest, the delusion implied in Mr Henson's expedient to supply the inherent deficiency of his moving power. These, however, are all obstructions of a kind which do not enter into the constitution of the forces with which the aerial machine upon Mr. Henson's principle has to contend. These forces, with which alone we have any concern, are simply those enumerated above, of which we have seen there is not one that offers any more opposition to the induction or establishment of a given rate of motion than it does to its continuance, and consequently imposes no obligation in respect of power to begin with, that it does not equally exact during the remainder of its career.

Had we had to deal with the *contrivance* proposed by Mr. Henson alone, we should not have had occasion for all this elaborate investigation in order to prove its insufficiency for the purpose ascribed to it. The force acquired by a descent, however accomplished or applied, must be assuredly inadequate to the production of any effects that could extend to a condition of elevation superior to that from which it had originated; as might be concluded at once from a consideration of the properties of the pendulum, which, in so far as regards the influence of gravity in communicating motion, is a parallel case with that which we are supposing before us. But here the parallelism ends, nor can any inference be drawn, as so confidently contended for (see *Mechanic's Magazine*, &c.) from the continuance of the motion in the one case to its continuance in the other by the instrumentality of a power inferior to what is required for its original establishment. The pendulum is not, in fact kept in motion by a power at all less than that by which it has been started, as a little consideration will evince. The force which puts the pendulum in motion is that employed in raising it to a certain height, from which it is allowed to descend by its own gravity. In this descent it acquires a force which would be equal to the original, and by which it would be carried up to an equal height on the other side, and thus reciprocate the movement without extrinsic assistance, were it not for the resistance of the air it encounters, and the friction of the parts in contact by which a part of it becomes expended or consumed. This portion is supplied by means of a spring. But it is not the spring that maintains the movement of the pendulum, but the attraction of gravitation conjointly with it, which together are exactly equal to the original impulse. Here, however, is nothing analogous to the case of Mr. Henson's machine, acquiring a momentum by means of a single descent down a plane, not to be repeated, and unprovided with a power equal to the counteracting forces, the friction and resistance of the air, with which it has to contend.

Having now conducted our readers through the mazes of this intricate, but we trust not uninteresting nor profitless inquiry, we would conclude with a few observations touching the prospects of that "consummation so devoutly to be wished for,"—the establishment of a successful mode of navigating the skies. One thing is clear; that, upon the principle of the plan we have been investigating, it is totally out of the question. The obligations imposed by the necessities of support, are of so exaggerated a character, that by no modification of construction, or application of new resources, can it ever rationally be expected to fulfil them. In an early part of this analysis we had occasion to point out the conditions in subservience to which these obligations are imposed. We there showed that the circumstance upon which the difficulties of the case really depended, was the relation of the weight of the machine to the superficial magnitude of the suspending plane, whereby alone the rate of progression was ascertained, to which all the requirements of power are ultimately referrible. By a reduction of the one or an enlargement of the other, therefore, is this principle solely improveable to the attainment of of success, and that, to an extent which a retrospect of past experiments and a general consideration of the nature of the case alike evince to be far beyond the reach of art to accomplish. Referring to the process by which the calculations in the preceding table may be applied to determine the conditions of flight assignable to other machines of the like principle, as detailed in the note annexed, it will be seen that the *smallest aerial surface* which could be made effectual to support the *weight* of Mr. Henson's machine, with the exercise of Mr. Henson's *power*, taking it at the greatest, would require to be upwards of 100,000 square feet in extent, or somewhat more than 22 times the area which Mr Henson has provided for the purpose. Nor can any argument in contravention of this conclusion be drawn from the proportion between the weight and superficial magnitude of the wings of birds, upon which so much reliance is wont to be placed by those who have hitherto written upon the subject. There is, in truth, no analogy whatever between the cases: neither consequently can any inference be legitimately drawn from what is effected in the one to what is possible to be effected in the other. The weight of birds in proportion to the size of their wings, may or may not be as great or greater than that attainable by art as between the weight of the aerial machine and the superficial contents of the suspending plane. Their purposes are entirely distinct, and accomplished through the intervention of essentially distinct properties. The bird possesses a power of unlimitedly increasing the reaction of its wings by their voluntary impact, which the rigidly suspended plane is devoid of, and which, by affording a compensation for any deficiency of size, neutralises all arguments founded upon a consideration of the relative proportion of weight, and removes the case out of all analogy with the machine constructed upon the principle of the plan before us.

Disappointed, therefore, in our expectations of success in this quarter, it may be asked, whither are we to direct our attention in order to discover the means of solving this perplexing but still interesting problem? The answer will most naturally suggest itself from a consideration of the circumstances to which the failure of all the attempts to navigate the atmosphere by mere mechanical impulse, the present among the rest, is entirely to be ascribed. These circumstances we have already specified in the exaggerated nature and amount of the obligations of support, occasioned entirely by the tenuity of medium and the force of gravitation; in the teeth of which we feel no hesitation in declaring our opinion, no process founded upon simple mechanical reaction ever can succeed; for even

if it were possible to contrive and construct a system of machinery by which the force required could be accomplished and applied, the violence with which it would have to operate in order to effectuate its purpose, (admitting its practicability,) would be such as to preclude the possibility of its employment.

To the balloon then, as affording the legitimate and only probable means of grappling with these difficulties, are we naturally referred: and that, by its means, success could be attained to such an extent, as to satisfy the scruples of the most incredulous, we are fully prepared to prove; not by the proposal of any crude and complicated contrivance, the operations and effects of which are neither defined nor definable, neither adjusted by the strict laws of science, nor reconcilable with practice, but by a mode at once simple in the extreme, susceptible of an examination as critical and close as that with which we have been sifting the scheme before us, and above all, answering the obligations imposed upon it by means so far within the limit of its attainments, as to leave no doubt as to its ultimate success, in some degree corresponding with the purposes which it might be expected to subserve. This, should our readers still continue to feel an interest in the subject, we may take an opportunity of laying before them upon a future occasion.

A SIMPLE METHOD OF COMPUTING THE SPHERICAL EXCESS, WITHOUT THE AID OF LOGARITHMS.

By Oliver Byrne, late Professor of Mathematics at the College for Civil Engineers; author of "*The new and improved System of Logarithms,*" "*The Doctrine of Proportion,*" "*The Practical, Complete and Correct Gauger,*" &c.

Although Professor Dalby's rule for calculating the *spherical excess* is simple, yet in many instances it is inconvenient, especially when logarithms are not at hand, or when the tables are limited; moreover, when the radius of curvature at the place of observation is greater or less than 365154·6 × 57·2957795 feet, a more appropriate constant logarithm than that given by Dalby might be used. However, it will be found in practice, that the *spherical excess* can be determined in all cases, by the method here explained, in one half the time usually employed to find the number corresponding to the difference of the logarithms mentioned by Dalby, (of which we shall speak by-and-bye,) and therefore the trigonometrical surveyor will in this particular calculation economise one half his time, at least.

The following table will be sufficient from 90″ down to $\frac{1}{1000}$ of a second, and can be increased or decreased at pleasure by multiplying or dividing by 10, if this range be not extensive enough; the change is easily effected by increasing the number of perpendicular lines to the right and left of those already drawn. Such an alteration may be necessary in speculative inquiries, but can never be required in practice. This method of calculating the *spherical excess*, which depends on the succeeding table, may be better explained by a few examples than by a written explanation.

EXAMPLES.

I. The area of a triangle is 1764724375 square feet; what is the spherical excess in seconds?

Area	1764724375		
Nearest in the table ..	1697710640	·8··	headed tenths.
Remainder ..	67013735		
Next nearest in the table	63664149	·3·	headed hundredths.
Remainder	3349586		
Next in the table ..	2122138	..1	headed thousandths.
	&c.	·831	

Therefore the spherical excess = 0″·831.

FOR	Thousandths of ″	Hundredths of ″	Tenths of seconds.	Seconds.	Tens of seconds.
1	2122138	3	0	0	6
2	4244276	6	0	1	2
3	6366414	9	0	1	8
4	8488553	2	0	2	4
5	10610691	5	0	3	0
6	12732829	8	0	3	6
7	14854968	1	0	4	2
8	16977106	4	0	4	8
9	19099244	7	0	5	4

II. Suppose that in the trigonometrical survey of Ireland, under the superintendence of Colonel Colby, the county of Wicklow, which occupies 21986496588 square feet, to be taken up with one large triangle, what would be the spherical excess.

	21986496588	Area in square feet.
10·0000 ..	21221383006	which terminate in the column headed tens of seconds, opposite 1.
	765113582	
·3000 ..	636641490	which terminate in the column headed tenths of seconds, opposite 3.
	128472092	
·0600 ..	127328298	answering to six hundredths of a second.
	1143794	
·0005 ..	1061069l	there are no thousandths of seconds, but 5 ten thousandths, found by curtailing another figure.
10″·3605 spl. excess. &c.		

III. The lengths of the chords of a spherical triangle on the surface of the earth are 13, 14, and 15 miles respectively; the area of the triangle formed by these chords is 2341785600 square feet, (which may be taken as the area of the corresponding spherical one, on account of the sides being very small compared with the radius of the earth.) The three angles of the plane triangle are 53° 7′ 48″·358, 59° 29′ 23″·136, and 67° 22′ 48″·506, required the spherical angles.

	2341785600	
1·000	2122138300	.. for 1 second.
	219647300	
·100 . .	212213830	.. for $\frac{1}{10}$ of a second.
	7433470	
·003 . ..	6366414	.. for $\frac{3}{1000}$ of a second
1·103 seconds the spherical excess.		

One third of the spherical excess must be added to each of the plane triangles to obtain the spherical angles. Therefore 1″·103 divided by three = 0″·368 nearly, hence we have,

Plane angles	53° 7′ 48″·358	59° 29′ 23″·136	67° 22′ 48″·506
Third of exs	·368	·368	·368
	53 7 48·726	59 29 23·504	67 22 48·874

In this example the excess is distributed equally among the angles, because there is no reason to believe one of them to be more erroneous than another. But if one of the angles be suspected to be less correct, or less to be depended on than the others, to this angle must be applied a greater or less portion of the whole correction, according as it is thought to be in excess or defect.

Dalby's Rule.—From the logarithm of the area of the triangle taken as a plane one, in feet, substract the constant logarithm 9·3267737, and the remainder will be the logarithm of the excess above 180°, in seconds, nearly. By this rule let us work the second example just given:—

Logarithm of 21986496588	10·3421561
Constant logarithm ..	9·3267737
Logarithm of 10″·3605	1·0153824

Dalby's rule, from the simplicity of the wording, and from the few figures exhibited in the operation, appears to be more convenient in practice than the one which we have given as an improvement, but this is not the case; for to find the logarithm of 21986496588, or the number corresponding to 1·0153824 from a table of logarithms, will employ more time than the complete working of the problem by the method here proposed, which may be thus investigated.

Let E be the area of a triangle in square feet; r = the radius of curvature at the place on the earth's surface where the triangle is situated, and A°, B°, C°, be the angles of the triangle considered as spherical, reckoned in *degrees and decimal parts of a degree*. By the well-known theorem of Gerard, $2\,E = 4\pi\gamma^2 \left\{ \frac{A^\circ + B^\circ + C^\circ - 180^\circ}{360} \right\}$ (A)

Suppose the triangle to be one employed in the trigonometrical survey of England, then the length of a degree may be considered equal to 60859·1 × 6 feet, without involving much error. Therefore the circumference of the globe to which this triangle is supposed to belong $= 360 \times 6 \times 60859{\cdot}1$, and $r = \frac{360 \times 6 \times 60859{\cdot}1}{2\pi}$

$$\therefore \text{(A) becomes, } 2E = 4\pi \left(\frac{360 \times 6 \times 60859{\cdot}1}{2\pi} \right)^2 \left(\frac{A^\circ + B^\circ + C^\circ - 180^\circ}{360} \right)$$

$$\therefore\ 2E = \frac{360 \times 6^2 \times (60859{\cdot}1)^2}{\pi} (A^\circ + B^\circ + C^\circ - 180^\circ)$$

$$\frac{2\pi E}{360 \times 6^2 \times (60859{\cdot}1)^2} = A^\circ + B^\circ + C^\circ - 180^\circ,$$ which we shall call *e*, or the spherical excess in degrees and decimal parts of a degree, which when reduced to seconds will stand thus:—

$$3600\,e = \frac{3600 \times 2\pi E}{360 \times 6^2 \times (60859{\cdot}1)^2} = \frac{\pi E}{1{\cdot}8 \times (60859{\cdot}1)}$$

but $\pi = 3{\cdot}1415926$ &c.

$$\therefore \frac{\pi E}{1{\cdot}8 \times (60859{\cdot}1)^2} = \frac{E}{\frac{1{\cdot}8 \times (60859{\cdot}1)^2}{3{\cdot}1415926}} = \frac{E}{\frac{(182577{\cdot}3)^2}{15{\cdot}707963}} \quad \text{(B)}$$

but $\frac{(182577{\cdot}3)^2}{15{\cdot}707963} = 2122138300{\cdot}6$, from whence the rule is derived. It is evident that Dalby's rule is in error when half the length of a degree is greater or less than 182577·3 English feet in the place where the triangle is measured; for by putting (B) into a logarithmic form we have Dalby's rule. But the constant divisor or its logarithm can be readily attained by substituting (B) for 182577·3 feet, half the length of any other degree in feet. However, the difference must be very great when the spherical excess is effected, of such triangles as occur in practice.

LIFE OF SIR DAVID WILKIE.

Poor Allan Cunningham! he had a poetical imagination and a grateful heart. He never forgot an obligation, and felt every kindness so warmly, that it was natural he should overestimate his friends who were interested in his welfare; he loved Sir Walter Scott, he adored Chantrey, and believed Wilkie (if the truth were confessed) to be greater than Raphael. The basis of biography is fact, bare, naked, disinterested, unqualified, undistorted, unpoetized, unexaggerated fact. Unless all the facts connected with the character described be correct, the conclusions must be false, and confidence destroyed. I fear the manufacturers of reminiscences, conversations, and biographies of late years have not been remarkable for adherence to this essential principle.

"When Foote tells me a story," said Johnson, "it makes me laugh, but it passes from my mind from its falsehood; when Reynolds tells me anything, I have an idea the more, for I know it to be a true representation of nature." Let every biographer print these words in letters of gold over his study door, and let him read them with attention whenever he feels inclined to give his imagination the reins at the expence of his understanding.

It may be said of all Cunningham's lives of artists that there is scarcely an anecdote told of any of them which happened in my time, which is not so *poetically* treated as to amount to a misrepresentation, though nothing was further from his desire or his principle. In the very first volume he states Wilkie was refused admission into the Academy of Edinburgh by Mr. George Thompson, and I, as well as others, felt the injustice as well as ignorance of Mr. Thompson. Now Mr. Thompson is alive, and luckily he is so, and he has given, in the *Morning Chronicle*, a flat contradiction to the assertion, and says it is "*not true*." Sir George Beaumont told me Boswell would race the town for days to ascertain the correctness of *yes* or *no*; as Mr. Thompson was alive, it was Mr. Cunningham's duty to have ascertained the fact, before he made so unjust an attack on a very worthy person.

No. 8, Norton Street, says Cunningham, was Wilkie's first residence, *then a coal shed;* now it was not a coal shed at the time, 1806, but a little front parlour! Wilkie's bed-room, sitting-room, and painting-room, and *there* he painted the Village Politicians.

He says again: something of Wilkie's reputation preceded him to London, for Jackson wrote to Haydon, &c. then in Devonshire. We never heard a word of him till he came to the Academy, and when he came, Jackson wrote to me. "Touched with Jackson's letter, Haydon came to London and went to the Academy. Wilkie, the most punctual of mankind, was there *before him*," says the author. Now Wilkie *did not come the first day at all*, and the next day *not till near one*—one hour and a half after his time! Because he painted to get his living, always before he came to the Academy, and Jackson, whom Lord Mulgrave maintained, and my father maintaining me, enabled us to be much more punctual than Sir David.

"Haydon," says Cunningham, "is an admirer of the grand style; but Wilkie, with a wider reach of mind, used to argue, "that though the rose excelled in beauty all other flowers of the field, we were not to despise the daisy, which had a loveliness of its own." *Very* like Wilkie's conversation. I imagine my dear old friend at that time, pale, thin, shrewd, legal, unpoetical and cold, talking the purest Fifeshire, scarcely understood in Auld Reekie, alluding in a strain of poetical language to the comparative beauty of the rose and the daisy! A wider reach of mind, too! So that I, who was devoting myself to see nature in the abstract, to clear the essential from the superfluous, and restore man, woman, and animal, to the essential properties in form of their respective species, as their great Creator sent them forth in Paradise to increase and multiply; I—who was thus fitting myself first, to master them as a species, and second, to put them in actions and expressions, to convey high moral lessons, to inspire the youth or elevate the country—was not of so wide a reach of mind as David Wilkie, who took man, woman, and animal as accident, disease, or dress had distorted them, painted them as they were in their humblest moments, without reference to moral objects at all, without relation, without abstraction, without choice!

He talks, too, very much of the smart pert students of the Royal Academy of that time. Except one poor fellow who is now insane, there was not a pert or smart student there—and the most loquacious, the most whispering, the most disturbing arguing student that ever lived, to whom we were all obliged to cry "Silence" repeatedly, was Sir David Wilkie. Wilkie was remarkably fond of loud whispering arguments, touching away with his port-crayon as he talked. "In my mind's eye, Horatio, I see him now." As to pertness, who was pert? Were Collins, Jackson, Mulready, Hilton, Pickersgill, Etty, and myself, were we *pert?*—we were the students, and our present station is an answer to such absurdity.

Page 76, Vol. I., he says, "Haydon was invited to breakfast; he knocked — a voice said 'Come in'; and he found Wilkie partly

naked, drawing his left knee." The fact is, I found Sir David stark naked as ever he was born, sitting on the edge of his bed, with a glass, drawing. "Wilkie," said I, my heavens, where am I to breakfast?" Without making a reply, he put his port crayon to his mouth to wet his chalk, and said without moving, "It's just capital practice, let me tell ye." "I'll take a walk," said I, and after a walk I found the room aired and bed turned up, and a good breakfast. It is astonishing how remarkable men are for particulars to impress you with an idea they are exceedingly correct, when they are not sure of it. The left knee! why not the *right*, why not *both*—and half of the right ankle—and four of the toes?

So idle and loquacious was Wilkie sometimes, that one evening when there was nearly dead silence, Fuzeli reading and nothing heard but the scraping of charcoal, Wilkie sent over to me some verses on his friend Crockat, the whole gist of which was doggrel rhymes such as,

My de[illegible]r Mr C[illegible]
Your name [illegible]

I added a couple, and it went nearly all round, and before it got half way, the students were choking with laughter. Fuzeli looked up two or three times with the light shining on his white lion head, in a suppressed fury. We went on drawing in an hysterical agony, to keep under which with our lips, and keep our faces sedate, I nearly bursted a blood-vessel. I believe I have the verses now. It is such nonsense, for biographers to talk as if their hero had none of the follies of life.

All the account of the journey to Devon, 1809, is a perfect absurdity. It seems Cunningham must have skimmed the journal in his usual careless manner. The facts of this journey are as follows. Whilst we were dining at the Admiralty, Lord Mulgrave, the first lord, asked us how we were going? I replied by sea. His Lordship said, Would you like to go in a man of war? We were delighted, and he told General Phipps at table, as he knew Curtis, the Port-Admiral at Portsmouth, to give us a letter to put us on board any man-of-war sailing to Plymouth! Away we went in high glee, to Portsmouth, we dined with Admiral Curtis, a fine old veteran of the siege of Gibraltar, there we met our friend Colin Mackenzie, then agent for Russian prisoners. As the Walcheren Expedition was collecting at Portsmouth, the men-of-war were coming up, so there was no frame, and we took our passage in a coaster, but just as we were going, Admiral Curtis came to the inn, and said, "will ye put up with a cutter?" "Certainly, a cock-boat in her Majesty's service," said I and Wilkie. "A cutter is now under weigh," said the Admiral, "I'll telegraph her!" In a few minutes, Moody, the commander, was at the Admiral's office, and Wilkie and I were put under his charge, as two very great men. Wilkie lay on his back in horror all the way and so insensible at times, that a carronade was fired over his very face, and he never heard it.

We arrived at Plymouth, my native town, in great glory, from whence I had issued five years before, an obscure youth, and we [illegible] landed by Moody, in full state, as if we were bullion for the treasury! Happy days! Moody was afterwards drowned, a gallant British seaman. I remember Sir David, hearing us all laughing, put up his head through the hatchway, he had a red nightcap, which with his pale face, was a picture, but before I could sketch him, he dropped, as if shot, below, nor did we see him after!

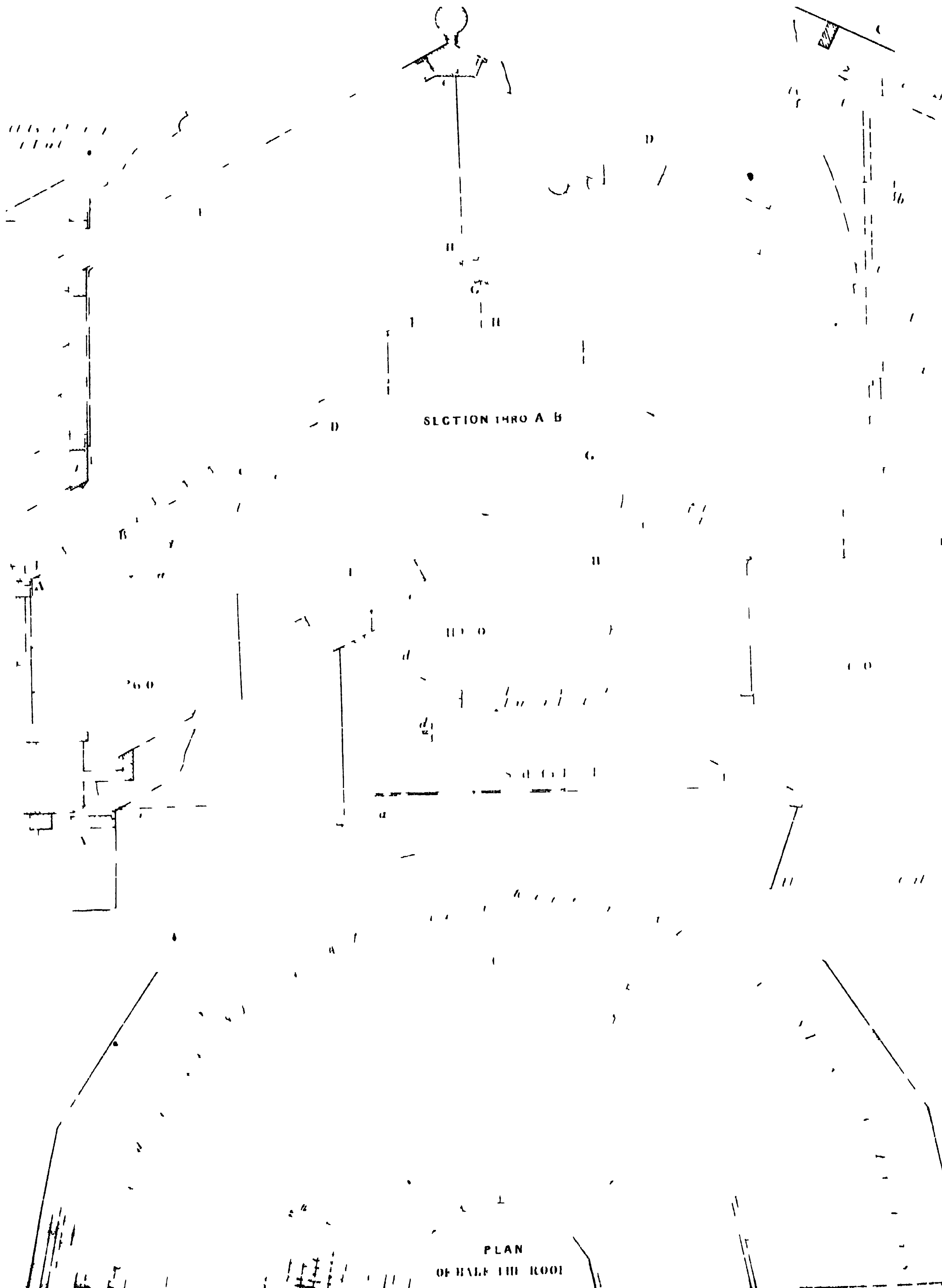
Cunningham says, he visited the Haydons, the Eastlakes, the Northcotes. Nonsense! He was my guest at my father's for a month. I introduced him to the Eastlakes. The author calls Sir William Elford, Sir Richard, but that is nothing. Wilkie made beautiful drawings of my father and my sister. Cunningham says, it was only of my sister, but that is nothing.

It is a curious instance of Wilkie's caution—I never knew he kept a journal, and he told my sister he did not. I have travelled with him, lived with him on the most intimate terms one man could live with another—he saw me at Paris put down my thoughts on art every night before going to rest. Wilkie told me he did not see its use, and after shaking hands and wishing me good night, must have gone to his own bed room, and done what I did not do, put down his remarks on me, and kept his journal of what his friends said or did.

It is extraordinary, also, to see how completely he agreed with me on the nature and evil of modern colour. He sneers, in his letters, at the pink and raw reds and yellows of the season—he asks what colour is the *go* for the spring? Page 300, vol. II, when speaking of Titian's superb Pietro Martyre—"this being the day on which the exhibition opens, one can scarcely view this great work but in contrast, *being almost an example of all that is the object of an artist to avoid when painting for that arena.*" 310—"One year is very like another at Somerset House! What Sir Joshua wrote and Sir George talked *was right*—and I am not now to be talked out of it." Again—"With us, you know, every young exhibitor, with pink, white, and blue, thinks himself a colourist like Titian." "I saw at Florence his Venus, his flesh (O! how my friends would stare) is a simple tint, *completed while wet.*" 117—"Reynolds' portrait at Florence has never cracked, and has never been varnished." At vol. III, page 12—"I painted up at once, a custom *quite denied in modern art.*" Would any believe that I have painted up at once all my life while wet—that I had preached this doctrine to Wilkie all my life—that he did it at first, gave it up, then went abroad, began it again, and talks of it as a discovery! Thus, after going to Italy, he comes to the same conclusions as Sir Joshua, Sir George, and Gainsborough, on the evil of want of tone.

To conclude as I began, on the exaggerations of this life; the author says, page 184, vol III, the artists gave Wilkie a dinner in 1806, in honour of the Politicians—that one of the set made a speech, and said "let us do honour to genius, but before, we must honour justice; and can justice be honoured, while England groans from side to side? I give the toast which will set all right, 'a full, free reform of the House of Commons.' 'Ah, but very moderate,' said Wilkie, *and emptied his glass.* It was long remembered as Wilkie's protest." What are the facts? as follows. First, no dinner was given to Wilkie in honour of the Politicians' time. It was in 1819 this was said, and not 1806, at my table, when John Scott, Mr. Otley, and Wilkie dined with me, and when all were in high glee, John Scott said, "let us drink Reform." Wilkie said, 'No, no—I mustn't,' we appealed to his courtesy, and Otley filled Wilkie's glass, he drank his wine to the dregs, and "*success to Reform,*" but frightened out of his life, turned round, and in a subdued tone said, "Very moderate, remember." We plagued him the whole night, and Otley threatened to write to the ministers, which put him in perfect horror. It was all joyous fun, knowing the man. This is the way lives are written, and facts perverted—speeches invented, and absurdities told.

With all these careless inaccuracies, which could have been all remedied by proper inquiry and revision, and which the author would have done had his life been spared, it is a most interesting life and ought to sell well. It has occurred to me as a curious question, why Vasari's lives are sold throughout Europe better than any other painter's lives, and the reason is, they are not exclusively professional, though a whole code of technical practice can be ascertained from his occasional technical allusions, both on fresco and oil, execution and cartoons, but I will venture to say if these utilities had been their only merit, they would have lain unread, except by artists all over the world. Not so Vasari, he had more sense. Every man can read his lives and be amused, because he mixes up all the vices, virtues, follies, and tricks, characteristic of each artist. We know Michel Angelo, and Raphael, and Juleo Romano, and Titian, as well as if we had lived with them, he tells us all sorts of anecdotes of their private lives. Fuzeli used to say to me, "What have we to do with their private lives?" I used to reply, "Every thing." It is these touches of human character in every painter, the humour of Buffalmacco—the violent temper of Michel Angelo—the suavity of Raphael—that interests the unprofessional man, the general reader, and have kept Vasari the very Bible of painting, and ever will. Whereas in the lives of Fuzeli, Laurence, Reynolds, and Wilkie, each in succession, is but a dry detail of professional correspondence, from which one retires harassed, disgusted, and sick; and after being published by a


SECTION THRO A B
PLAN
OF HALF THE ROOF

bookseller at a great expence, lie on our shelves after the first excitement, and are never referred to either for instruction or entertainment. Every painter's life could be made as delightful as a novel.

In spite of all these defects, this life contains a great many useful things. Sir David Wilkie greatly overrated the value of going abroad—did serious injury to himself, and injured two of his friends, who got into a style, neither English or foreign, to the ruin of either style; he was apt to have serious hallucinations of mind, and whilst they lasted he was perfectly sincere, but if he seduced inferior minds to follow him for the time, it was likely, before the next season, he would startle them by running down with equal enthusiasm what the year before he had so earnestly worshipped! But he was a kind friend, a good brother, a dutiful son, and a high moral character. He founded our domestic school; and if ever man left this world fit to appear instantly before his Maker, it was DAVID WILKIE.

B. R. HAYDON.

London, June 12, 1843.

LONDON AND BIRMINGHAM RAILWAY.

ROOF OVER THE LOCOMOTIVE ENGINE-HOUSE, AT BIRMINGHAM.

(With an engraving, Plate X, drawn to a scale of $\frac{1}{16}$ of an inch to the foot, and the enlarged parts ¼-inch to the foot.)

THIS building was erected about five years ago; it is a polygon of 16 sides, and was originally covered by a roof having an open area in the centre: but this being found not to afford sufficient protection, from the inclemencies of the weather, to the men employed about the engines, the roof was removed during the autumn of last year, and replaced by another, the construction of which is shown in the accompanying engraving; it is simple, and at the same time an excellent combination of timber and iron.

The ring of columns and connecting girders, (shown in enlarged part C,) used in supporting the old roof, was retained for a similar purpose in the new one. On reference to the engraving, it will be seen that the roof is supported upon this ring, and upon the exterior walls of the building. The thrust upon the walls is neutralized by the tie rods *a*, which connect the head of each column fig. C, with the shoe of the opposite rafter fig. A. Upon the head of the column is fixed the stanchion *b*, which carries the curved brace *c*, these, together with the strut *d*, all of which are of cast iron, form the point of support for the rafter *e*.

The heads of the rafters meet in a cast iron curb *f*, shown in the enlargements E, upon which the lanthorn F, is erected; this curb is cast in eight portions, and firmly bolted together. The plan of soffit of the lanthorn is shown at G, and the junction of tie bars at the foot of the ring bolt at H.

The cost of the roof is as follows:—

	£.	s.	d.
1795 cubic feet of Memel fir, edges chamferred, at 4s...	359	0	0
110½ squares of 1-inch deal boarding, the edges shot, underside coloured in distemper, at 40s.	221	10	0
1094 feet run of hip roll, at 4*d*.	18	4	8
640 feet super. gutters and bearers, at 1s.	32	0	0
1248 feet super. 2-inch bevel bar skylights, glazed with British sheet glass in large squares, at 3s.	187	4	8
160 feet super. 2-inch wrought boards, at 1s. ..	8	0	0
134½ squares Duchess slating, copper nailed, at 30s. ..	201	15	0
9 tons of lead, at £28.	252	0	0
25 tons of cast iron, fixed, at £10.	250	0	0
4½ tons of wrought iron, at £22.	99	0	0
1163 super. yards painting four times in oil, at 1s. ..	58	3	0

CANDIDUS'S NOTE-BOOK.

FASCICULUS L.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. Our Note-Book is getting old—it has reached its Fiftieth Fasciculus; no matter—provided it has not actually fallen into its "sere and yellow leaf," and does not begin to exhibit symptoms of dotage. No doubt there is a good deal of repetition in it—much that is nearly, the same in substance has been touched upon again and again; yet not, I conceive, needlessly so, because it is only by their frequency that similar "morsels of criticism," can be expected to make such impression as to be of real avail. It may, perhaps, be said that the criticism itself becomes in time a bore; and so, indeed, it would, were every one else also to deal in it after the same fashion, and just in the same strain. But people have no reason to complain as yet of being overdosed with architectural criticism, except of a respectably tame and stale kind.

II. What a sad pity it is that Klenze did not come over to this country and take a lesson from the Hanging Committee at our Royal Academy, before he fixed his plan for the arrangement of the busts in the Walhalla. They would have shown him how *featly* he might have packed together as many thousands of them as there can now be hundreds, by having a row of them upon the floor, and piling up the rest upon shelves to the very ceiling. No matter whether seen or not, provided the things be but there. Our Academy seems to be of opinion that the nearer the ceiling the further out of harm's way, and out of the reach of criticism; and it would be well were some of them to exalt their own works so high aloft, that the most lynx-eyed critic could never make them out. Turner, for one, would show great judgment in doing so, because then we might fancy there was some meaning in his daubs and blotches. By the bye, what does Turner do with such things? he can hardly make use of them as waste paper yet some of them look very much like it.

III. Would that columns could be melted down as well as cannons, because were that possible, something might yet be made of the gigantic stone post, stuck up in Trafalgar Square, and which now seems to be sticking quite fast. The Athenæum tells us "it is still *insinuated* that it will one day be completed,"—perhaps at the Greek calends, for that day does not seem likely to come in a hurry. In the interim, therefore, the scaffolding might as well be taken down, instead of letting it rot to pieces, as it undoubtedly will do, if kept up until the work is completed, for by that time the column will probably have become a venerable piece of antiquity. In its present state, it is quite monument enough—a sufficiently significant one, and strikingly indicative of the sort of intelligence and taste which presided over the whole affair. If a column was deemed the most preferable form, upon the whole, for the monument, it should at least have been one of original and imposing character—a fine conception, treated in a noble style, whereas the thing now stuck up will inevitably have a puny look, and will be both lanky and top-heavy, the mass of the Corinthian capital being especially unsuitable for a detached column which has nothing to support—and considered with reference to the shaft and capital, the statue becomes tantamount to nothing, except there be some latent and malicious meaning in it, intended to make evident to us the littleness of the greatness that is stuck up above the heads of the rest of the world. If we had had nothing of the sort before, a column of the kind might have been welcome as a novelty—and for that very reason, perhaps, would have been protested against, as something remarkably fanciful and strange; but we have already so many examples of them stuck up all over the country, and all pretty much on a par as to insipidity, that it would be more desirable to get rid of some of them, than to add to their number. What all those bits of architectural trumpery may have cost it would be fearful to compute, but no doubt as much as would have sufficed to erect one or two edifices that would really have been genuine monuments of art—an honour to the nation and to the age.

IV. Who is this "Aunt Elinor," who has just started up as a female professor of architecture, in the hope, it would seem, of being able to *lecture* ladies into a love for the study of the art? The idea itself—which, by the by, she seems to have borrowed, or rather stolen without acknowledgment, from Wightwick, is surely a most preposterous one, since what occasion can women possibly have for understanding aught of architecture? or are they even capable of attaining to any intelligent knowledge of it? Are all our studies to be invaded by the present Amazonian race of females? or is their ambition insatiable? Already have they mastered all our *ologies* and all our *onomies*, and now, forsooth, they must attack what we have considered an impregnable fort—architecture—though, to confess the truth, it is not every one who has displayed any particular *feat* in it. Surely the ladies might be content with the plunder they have got from us—among the rest, geology, a study remarkably amusing, and to them most particularly useful. But architecture!—oh no! we must not allow them to come poaching upon that preserve. What would become of us he-creatures—professors and all, should it be discovered that women could attain to any competent knowledge of architecture as a fine art—and perhaps be able to design a classical portico just as easily as they can hem a handkerchief? No, instead of admitting women, we rather want to get rid of some of the "old ladies" of the male sex, who are actually in the profession. Still it must be admitted that a very great deal may be said on the other side of the question, nor is Aunt Elinor's idea so very preposterous after all. Women, it may be presumed, are fully capable of appreciating what, in its quality of a fine art, apart from the science and mechanical skill required for the practice of it, addresses itself so much both to the eye and to the mind, and exercises the judgment as well as the fancy. They ought to be able to feel all its harmonies of proportions and combinations, and to enter into those delicate minutiæ and subtle coquetteries of the art, were they but sufficiently instructed to understand them, and know in what they consist. At present, indeed, such is not the case, because architecture has a language of its own, which must be studied before its productions can be *read* or relished. If there be such a thing at all as poetry in architecture, *that* surely can be felt, and not only felt but as distinctly and with as clear perception of the immediate causes of it, by one sex as well as the other. For my own part I am inclined to think that were ladies but to apply themselves to the study, they would in general make far better critics in all matters of architectural taste, than men do. Hardly would they pardon those negligencies and that slovenliness which are now so frequently drawbacks on what are in other respects designs of considerable merit.

What an encouragement, too, it would be to architects themselves to know that their works could be intelligently appreciated by judges of the other sex—whose suffrages, as matters are now, they consider quite valueless, and their praises mere empty compliments, flattering to the ear, yet meaning nothing. Let the study of architecture be taken up by ladies, and by educated persons of the other sex, and instead of being as at present considered an exclusively professional one, it would acquire a degree of popularity that would have a most beneficial influence on the art itself. To say that because such persons can study it only partially—or, as a fine art and in its history as such, that they therefore ought not to attempt to study it at all, lest they should be sneered at, perhaps, as mere dabblers and pretenders, is manifestly absurd, or at any rate it ought not to be expected by professional men, that non-professional people should encourage it at all, since what can it matter to them whether the taste shown in it be bad or good? Why, in the name of common sense, should people be reproached for not paying due regard to, and not encouraging what they themselves are discouraged from attempting to study and endeavouring to understand? Even the ignorance of the general public may, however, have its advantages, and one of them is that a "*Pecksniff*," or a ——— will do quite as well for such a public, as a Charles Barry.

GROSVENOR HOUSE.—THE NEW SCREEN.

The most aristocratic streets at the west end of the town have very few attractions indeed for the admirers of architecture, being far more remarkable for the absence than for any display of taste. They have a certain air of opulence about them, not to be mistaken; but it is entirely in "undress," so that nothing can be more homely and insipid than the "magnificent squares"—as they are often bouncingly termed—in that quarter of the metropolis. Grosvenor Square is no exception, for if it contains some mansions above the average in point of size, it also presents some that are of more than ordinary ugliness. In Grosvenor Street, however, there is now a rather striking and novel architectural display, which loses nothing of its effect by the contrast it forms to the insipid monotony of that fashionable district. We allude to the new screen erected in front of Grosvenor House, the residence of the Marquis of Westminster, which is designed, as we understand, by Mr. Cundy, and which, taken by itself, is very handsome both in its design and its effect, and is far more happily composed than what, by serving as a precedent for it, may seem to detract from its originality. Though we have not as yet heard this screen compared to that before Carlton House, we should not be very much surprised to find it described not only as a copy, but as a miniature copy of it. A decided improvement upon it, it may fairly enough be termed, for while it can be likened to that example only with respect to the general resemblance arising from the same general disposition, every point of similitude is also one of difference, and that difference is decidedly in favour of the present design, as would have been evident enough were the other still in existence. It is not, indeed, to be compared with it for extent, being, perhaps, only half its length, if quite so much—for we do not know what were the exact admeasurements of the screen at Carlton House, neither what are those of the one we are now speaking of. But this last is certainly treated in a nobler and *larger* manner, and is far more consistent and complete. Here the entrance gates are rendered important and beautiful features, that both give value to, and are aided in turn by, the open colonnade between them; which was certainly not the case in the other instance.

The composition consists of an open colonnade, of the Roman Doric order, placed upon a low stylobate, (about four feet and a half high,) and connecting the two gateways. These last form slightly projecting breaks at the ends, and have coupled columns of the same order, with the entablature breaking over them, in such manner that the cornices of the pediments project considerably, owing to which circumstances these parts of the design possess a certain degree of mass and energy; the archways do not look like mere shallow openings, but by acquiring some depth the roofs of the pediments show themselves boldly in perspective. The gates themselves are highly ornamented, being of rich open-work pattern in cast-iron in imitation of bronze, which colour and style of decoration is judiciously carried out by the candelabra or gas standards, one of which is placed in each of the seven intercolumns of the open screen.

Thus far, we can bestow almost unqualified praise, for the whole is well composed and well studied, most pleasing in its *coup d'œil*, and unites a happy mixture of airy playfulness and solidity. It has converted what was before a mere gap between the adjoining houses, into a most attractive piece of architectural decoration; yet though, as such, it does not seem too ostentatious or of too great pretension in itself, it certainly is so if considered as an appendage to the building before which it has been erected, or we should express ourselves better by saying that this last is utterly unworthy of what has thus been made to accompany it. In those who are not aware that the screen is a mere after addition, the first sight of it cannot fail to raise expectations of some corresponding if not exactly equal degree of architectural display in the mansion itself. Great, therefore, must be their disappointment, when on a nearer approach they discover behind this colonnade merely a plain-fronted house, which even as such has no beauty of proportions, nor any air of dignity. The contrast in this respect would be ludicrous, were it not also vexatious and annoying. Are we never to see anything carried out consistently and

perfected throughout?—must there almost always be something to operate as a drawback on our satisfaction, and to mar our enjoying what we might else admire? To mention economy in such cases by way of excuse, is no apology at all;—it is like buying a costly picture-frame and hanging it up empty, because you cannot afford or else begrudge the money to purchase a painting to put into it; and though it is done every day, it is a very strange kind of economy that induces people to spend their money merely, it would seem, to convince the world that they lack either the means or spirit to do handsomely what else there is no occasion to do at all.

Possibly, however—and we are willing to hope that such will be the case, it may still be intended to complete what is here begun, and that as a screen has been added to the house, a house will in due time be added to the screen—that is, a facade on this side, of corresponding character. If not, we can account for what has been done, only by supposing that the noble owner has built chiefly for the gratification of his own eyes—not so much with any idea of improving the appearance of his house—which now looks more insignificant than before, as for the purpose of providing a beautiful architectural object to be seen from his own windows, so that in fact he may be said to have followed Lord Chesterfield's advice, and erected a front "over the way" for himself to contemplate.

That the effect of the screen as beheld *from* the house must be very striking, and form quite an architectural picture, there can be no doubt, and not least so of all when lighted up by gas at night. But then, besides that such consideration does not reconcile us to so much being left undone, by carrying out the ideas suggested by the screen, the whole space between that and the house might have been rendered a highly ornamental, though rather small *cortile*, whereas at present, it has no architectural character, or no more than what amounts to a sort of apology for something of the kind. Indeed, if nothing further is now to be done, it becomes a question whether it would not have been better to make the screen more of a screen than it now is, by filling up the intercolumns, for about half their height, with metal work of the same pattern as the gates. In this there would have been novelty, and certainly no inconsistency. There were, besides, many other ways by which the same purpose could have been accomplished, and as one of them we may mention that of adopting for a design of the kind, an order of square pillars instead of columns, raised not on a stylobate but merely a socle, with intercolumnar screens of masonry between them, carried up to the level of the imposts of the archways; in which case the lamps would be placed on those screens, and these last might be embellished with bordered sunk panels (in the manner of those now over the two doors at the ends,) with reliefs, not in stone but *bronze*.

We have said nothing as to the absurdity imputed to the idea of a row of pillars or columns employed merely as a wall—at least as a wall with openings in it. The objections urged against it as being such, appear to us pedantical and hypercritical. Columns, we grant, were not originally intended for such purpose, but it does not therefore follow that a different application from the one originally contemplated must necessarily be bad in itself. Were such the case, we must abandon much that is now considered perfectly legitimate, and is tolerated, if not always admired. If, too, absurdity there be in using columns that support nothing but their own entablature—which then becomes the top or coping of the perforated wall described by those columns;—how much more extravagant, and remote from the original purpose of columns must it be to employ them singly and without their having anything at all to support, except it be a "black image" perched upon the top of the capital, yet not looking so much as if it had alighted from heaven, as if it had ascended from the infernal regions. If, therefore, we can endure absurdities of that kind, merely because antiquity has left us some precedent for them—of which, however, our modern copies fall very far short indeed—we may surely reconcile ourselves to what, while it is a degree or two less absurd and a less preposterous conceit, can hardly fail to produce a strikingly picturesque perspective effect, let the design itself, considered apart from such effect, be what it may.

CONSTRUCTION OF A BÉTON BRIDGE.

Description of a Bridge of Beton,[1] *constructed at Grisoles, in the Department of Tarn-et-Garonne, in France. By* M. LEBRUN, *Architect of Montauban.*

Translated for the Journal of the Franklin Institute from the "Bulletin de la Société d'Encouragement pour l'Industrie Nationale," for July, 1842. By Ellwood Morris, Civil Engineer.

Living in a region where suitable building stone is scarce and expensive, and where brick masonry alone is used, M. Lebrun, guided by the fine works of M. Vicat, on hydraulic limes, conceived the idea of substituting for this masonry the *béton*, which the Romans used with so much advantage.

In consequence, he submitted, in 1839, to the Minister of Public Works, the project of a bridge entirely of *béton*, which he offered to construct on the lateral canal of Garonne, to be traversed by many of the royal and departmental routes. This after having been accepted, under certain conditions, M. Lebrun commenced his work in June, 1840.

The *lime* was of the hydraulic quality, burnt in perpetual kilns, by pit coal. The *sand* was clean of all earthy particles, of fine grain, and pretty uniform. The *gravel stones*, of the size of a hen's egg, came from the river Garonne. The lime was slaked alternately in two basins, joined together. For this purpose, we poured at first, in one of the basins, a quantity of water proportioned to that of the lime which we wished to slake; we then put in sufficient quicklime for the water to cover it; then we left the lime to slake freely without disturbance, except by taking care to prick it, from time to time, with a stick, to introduce the water into those parts of the basin where the dissolved lime was dry. When the fermentation had ceased, we stirred up the lime in every direction with an iron hoe, in order to mix the paste, and render it homogeneous. We left it then in this state, not to be used for twelve hours after slaking.

The proportions observed by M. Lebrun for *béton* destined for the construction either of walls or arches, were, in every ten parts, composed of two parts of lime in paste, three parts of sand, and five parts of gravel stones, or pebbles.

For making the mortars, we placed, on a paved surface, two measures of the slaked lime, which, after having been well beaten with pestles of cast iron, softened again by yielding up a part of the water with which it was charged, then we placed beside it three measures of sand, which we mixed, little by little, with the lime, always having the aid of the pestles, and stirring the whole with the shovel and hoe, in order that all the parts of the sand should be well incorporated, observing not to put any water into the mortars, but, if the sand was too dry, we moistened it, a few moments before mixing. As soon as the mortars were sufficiently manipulated, we added five measures of gravel stones; the whole was then long and forcibly mixed and pounded, until each part of the gravel was sufficiently enveloped by mortar; then the *béton* was taken in quantity, to wait for the moment of being used. We took care to make only what we could employ in a day's work, without which precaution it would have lost its cohesion.

The 15th of June, 1840, the excavation of the foundations of the two abutments being done, we commenced laying the *béton*, taking care, each time that a layer, or course, was finished, to cover it up immediately with wet mats of straw, to prevent a too rapid drying by the heat of the sun. By means of this precaution, the new course connected itself more intimately with the one below. We continued

[1] The French béton is nearly [illegible] with the English concrete, the main difference lying in the manipulation. This béton is composed of lime, sand and small pebbles or broken stone taken separately, and successively mixed together, the pebbles being added last; while concrete is usually formed of lime mixed directly with gravel, containing naturally about the due proportion of pebbles and sand, proper quantities of water being used, and the fictitious stone resulting in both cases being in effect the same.

Béton or concrete has before been used in constructing walls and other constructions, and as is stated by General Pasley, of H. B. M. corps of Engineers (in his admirable Treatise on Calcareous Cements,) it was also applied experimentally to build a military casemate near Woolwich, of which the arch had 18 feet span, 5 feet rise, and 6 feet depth at the crown, and which, when subjected to the direct fire of 24 pounder guns, as well as the vertical plunge of 13 inch shells, loaded to weigh 200 lb. each, resisted both with success, and, contrary to expectation, was less injured by the latter, than by the former.

We must however here observe, that the failure of the concrete wharf walls, at Woolwich and Chatham, in consequence of tidal exposure, and the necessary protection of the concrete sea wall at Brighton, with woodwork, to shield it from the action of water in mass, (as mentioned by General Pasley,) points out the necessity of confining the application of concrete to constructions within reasonable and proper limits.

the masonry all of *béton*, (the backing of the arch and abutments keeping pace) until reaching the height fixed. The exterior faces of the abutments (not next the earth,) and of the walls, were formed by some planks strongly fixed, against which the *béton* rested. These planks were removed, two or three days after, and the faces of *béton* remained exposed, and were very well preserved. At the height of the springing of the arch, we laid five courses of bricks plumb on the faces of the abutments, to serve as perpendicular faces for the centre to fit up against, and enable it to detach itself easily.

Fifteen days after the laying of the last *béton*, we commenced the construction of the centre, composed of many courses of bricks, laid flat, in succession (from the springing towards the crown,) following the curve of the arch at the intrados, built partly with plaster, and partly with cement, or hydraulic mortar, and supported at the springing by projecting masonry, or by a timber for that purpose. The centre was formed of four courses of bricks (in thickness, or depth, six nine inches), the three lower were laid with plaster, and the upper course with cement, to shelter the plaster from the dampness of the *béton*. The upper bricks of the centre were covered by a bed of mortar or clay, in order to mould perfectly the intrados of the arch, and to hinder the *béton* from forming an body with the bricks.

The construction of the centre being finished on the 17th of August, we established, three days after, the masonry of the two heads of the arch of brick, (and of quoin stone,) which were completed on the 26th of the same month.

Immediately after the construction of the two heads, we wrought them into the general mass of *béton*, forming the arch; this operation was finished on the ... of September, with the exception of the backing up, which was accomplished, on both sides, the 11th of the same month. The *béton* of the arch was composed in the same manner as those of the abutments, and manipulated by the same process; but we added to it 2 cubic feet of *cement* for every 3½ cubic feet, or ... th of the mass, to augment the strength of the mortars of the body of the arch. This construction was made without following any regular order, and the *béton* was cast in masses, upon the centre, to the thickness of two feet, which formed the first general bed, or layer, on the development of the arch. This first bed being finished, we formed the second in order to reach the thickness of three feet at the key, the spandrel backing, and the abutments being levelled up. A coping of hydraulic mortar was then placed over the whole extent of the arch, and covered immediately with a layer of clay, strongly beaten.

All was left in this state until the 2.. th of January, 1841, we then proceeded to the operation of the striking of the centre of the arch. The 28th of January, the centre of bricks was taken away, and the intrados of the arch appeared very even in all its parts. After three months, it manifested not the smallest settlement in its masonry, and, since then, the bridge has stood through the summer, without incurring the least degradation capable of affecting its solidity. This bridge has clear opening of 39½ feet between the abutments; the middle is placed in the axis of the canal, which has two towing paths; its breadth ...

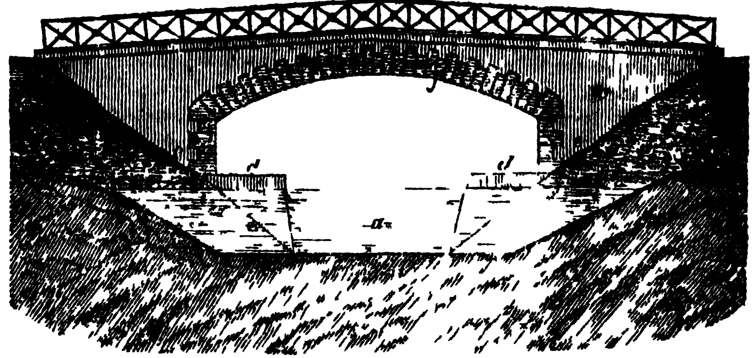


Fig 1.—Elevation.

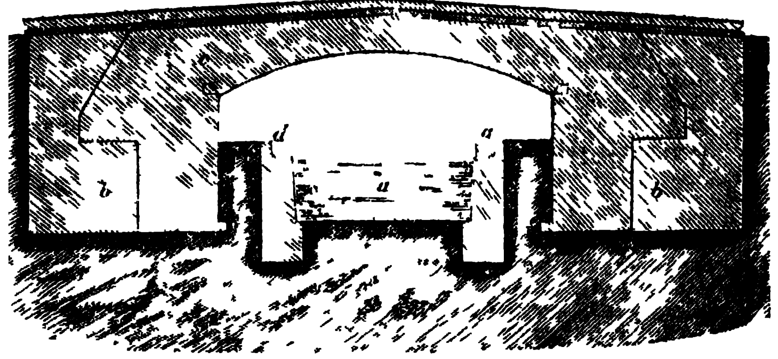


Fig 2.—Section.

EXPLANATION OF THE PLATES.

... arch ... of ... *béton*, ... large stone with the ... rounded ... of bricks ...

... between the heads, or faces, of the rings and the arch is formed of a segment of a circle of 39½ feet chord, and ... feet rise, or versed sine.

The entire mass of the abutments is of *béton*, except the four angles on the sides of the towing paths, which are of large stone, rounded on the arris, on account of the rubbing of the towing lines. The arch is also of *béton*, as are the faces of the tympans, or spandrels, and the intrados with the exception of the arrises of the soffit, or quoins of the heads, which are of brick.

M. Lebrun has joined to his memoir, along with a plan of the bridge of Grisolles, many certificates, from the mayor of this commune, and from the engineer of the lateral canal of the Garonne, proving the complete success of the works, and the solidity of the construction, which has endured the proof of the passage of loaded carriages, the numerous influences of heat, and some very severe frosts, without having suffered the least degradation.

OLD LONDON WALL.

A LETTER FROM M. ... F.R.S., &c.

Some ... ... not altogether slight ... &c.

On the west side of a vacant plot of ground in George Street, Tower Hill, and behind the houses in Trinity Square, stands one of the most considerable remaining portions of the wall which was in early times built for the protection of *Londinium* (probably at the commencement of the fourth century,) and which for some time was considered of the utmost importance, and kept constantly repaired. As, however the number and power of the citizens increased, they outgrew their shell, (it was but a small one,) and the irruptions of barbarians ceasing to be frequent, this protection was considered of less and less consequence; until at last, as Camden observes, the Londoners slighted fenced cities, as fit for nothing but women to live in, and looked upon their own to be safe, not by the assistance of stones, but the courage of its inhabitants. Year after year has witnessed the gradual destruction of the remains of this ancient enclosure, until, with the exception of a bastion in Cripplegate Church-yard, the portion behind Trinity Square, of which I am about to speak, a continuation of it forming the back wall of Mr Atkinson's hemp warehouse in Cooper's Row, and a few inconsiderable fragments to be found in the street to which it gives its name, it has been entirely swept away.*

The portion in question is also now threatened with destruction, and the object of this communication is in aid of other efforts which have been made, to induce those who have authority to re-consider the matter, with the view of avoiding this objectionable step if possible. It is intended to build a church on the vacant ground in George Street with the special object of affording accommodation to the masters, officers, and seamen of the ships in the docks and the river, and it is considered that the site of the old wall "is essential

* For interesting particulars of the old wall see Strype's edition of Stow's Survey, chap. II, p. 7. Also Knight's "London," vol. I, p. 160.

for the satisfactory completion of the church." A memorial was presented to the Common Council from members of the Metropolis Churches Fund, in February last, praying them to "grant permission for the removal of the materials of the wall, and to convey to Her Majesty's Commissioners, for building additional churches, the ground on which the wall now stands." This the Common Council granted; so that the fate of the wall is decided, unless those gentlemen in whose hands it is placed can be led to regard the subject in a fresh point of view. Their object is unquestionably an excellent one. far be it from me, even if I had the power, to throw the least impediment in the way of it. The gentlemen who are interesting themselves in effecting it are of undoubted character and worth, and I cannot help concluding that the proposal to destroy the wall was made in the first instance without serious consideration, and that now public opinion has been strongly expressed on the subject, other means will be taken to obtain sufficient ground for their purpose, or that the plan of the proposed church will be altered so as to adapt it to the land already in their possession.

The length of the wall is 48 feet, irrespective of a part of it which forms the end of some adjoining premises: the height next Trinity Square is from 20 to 25 feet, and the thickness, as nearly as can be estimated, about 6 feet. In times less eminent for the preservation of ancient monuments than the present day, it was coped with brick work, and strengthened at the northern angle, and is consequently in a tolerably good state of repair. It is faced on both sides with masonry in courses, (the interior being of rubble work,) and shows occasional layers of Roman bricks. On the west side the facing consists in parts of alternate courses of square and flat stones, and the Roman bricks are few in number and very irregularly placed, so as to lead to the belief that it was reconstructed perhaps in the Norman period. On the other side, however, some vaults which adjoined the wall having been destroyed and the ground cleared away, a considerable portion is exposed to view—which is doubtless the original Roman wall, probably not less than fifteen hundred years old, yet still quite sound and perfect. The masonry is of broad squared stones, systematically bonded, and there are two or more continuous double layers of Roman bricks, agreeing precisely with other remnants of the original wall described by various writers. Dr. Woodward, who examined part of the old wall in 1707, when some houses were pulled down in Camomile Street, measured the bricks which were in it very accurately, and found them 17[illegible] in. long, 11[illegible] in broad, and 1[illegible] in in thickness. The bricks in the wall now in question, measured without remembrance of Woodward's dimensions, I noted as 17 in. long, and 1½ in thick. The double layer, including the mortar between the bricks, measures altogether 4½ in. From the top of the lowermost layer, or that next the ground, to the layer above it, the masonry measures 3 ft. 6 in., from the top of this up to the next double layer, the masonry measures 2 ft 7 in.

Of the value of this interesting relic of antiquity, the desirableness of preserving it as a portion of the past for the service of the future, I would speak strongly. Monuments of this description become historical evidences, nationally important, and are continually found to be of the greatest service when tracing those changes in our state and manners which time is constantly effecting. They are links in a chain which connects the present with the past—awakeners of sentiment, silent teachers—and have never been destroyed without much after regret and condemnation.

> "Past and future are the wings
> On whose support harmoniously conjoined,
> Moves the great spirit of human knowledge."

The importance of the study of antiquity, notwithstanding some few apparent proofs to the contrary, is now very universally admitted. "It was at one time the custom, amongst the people generally, (as the writer has elsewhere ventured to remark,) to reward the labours of the antiquary with ridicule and contempt—to consider the investigation of a ruined building, the preservation of a piece of pottery, or the noting down of the manners and customs of past ages, as the mere idlings of weak minds, and that he, who so employed himself, was not merely unworthy of praise, but deserving of censure for misapplying time. The value of the works of this class of men, is now, however, better understood, and therefore more duly appreciated. Through the exertions of these "musty" antiquaries, the civilized world is able (if we may so speak) to look back upon itself, and contemplate, in a great degree, its actual state, so far as regards the arts which flourished, the sciences which were understood, and the consequent position of the people, at various periods of its age; and that, too, not merely in the accounts of contemporary and succeeding writers, but in the very results of these arts so practised—in the coins used, the dresses worn, the furniture employed in their houses, and the buildings raised for ecclesiastical, for warlike, or for domestic purposes."[2]

The architecture of a people especially, offers important evidence, in the absence of written records, towards the elucidation of their history; perhaps we may say the most important—for it speaks plainly of the state of society at each particular period, and hints at the degree of knowledge possessed by individuals, or by the people at large. As the comparative anatomist can from one bone determine the size, the shape, and the habits of an animal, which he has neither seen nor heard of, so may we almost discover, from the ruined buildings of a people, their prevailing habits, their religion, their government, and the state of civilization to which they had arrived.

Not to digress, however, from the immediate subject of this communication. The proposed demolition of the remaining portion of London Wall affords another instance of the advantage that might result from the establishment of a public board for the preservation of our ancient monuments similar to the *Comité Historique des Arts et Monumens*, of Paris, who when local requirements threatened the destruction of what in reality belongs to the whole nation, might interpose their authority, and prevent the contemplated injury. In the present case it is to be hoped that the Society of Antiquaries will not fail as a body to use their influence for the protection of the wall. At a recent meeting of the Royal Institute of Architects, the writer, at the request of a large number of gentlemen, brought the matter under their notice. The Marquis of Northampton, who was in the chair, expressed a hope that the wall might be saved, and suggested that the Council of the Institute should communicate with the Society of Antiquaries, with a view to the presentation of a joint memorial on the subject. The Council of the Institute adopted the suggestion, and it is to be hoped that such a representation will consequently be made to the excellent gentlemen with whom the fate of the wall now rests, as to lead to its preservation whole and uninjured. Whether so or not, the writer feels he has but performed a duty in raising his feeble protest against the destruction of a most valuable and interesting memorial of the early history of the city.

GEORGE GODWIN.

ARCHITECTURAL DRAWINGS, ROYAL ACADEMY.

(Concluded from page 195.)

By the same architect, are one or two other designs of great merit, No 1168, "Forest Cottage, the shooting residence of the Marquis of Breadalbane," answers perfectly both to its title and its purpose, having a look of most comfortable homeliness, and an air of genuine rustic picturesqueness in its ensemble, without any of that "make-believe" and affectation which frequently cause "genteel cottages" to appear strangely finical, and to remind us of the "tea garden." No. 1351, by the same, "Model of Walhurst Castle, showing the alterations now nearly completed," also shows what a hideous piece of ugliness the house was, as first erected, and how happily it has since been metamorphosed, so as to be now a very pleasing and well combined design, marked by a good deal of expression in its details; whereas originally there was nothing whatever of the latter, while taken as a whole, the house was a mere insulated lump, unvarying in appearance, in whatever direction it may have been viewed. Such is by no means the case now, there being a very great deal of perspective play—of movement, fore-shortening, contrast,—a merit that confers varied interest on a building, and which renders the design we are speaking of, a very suitable subject for a model. Architectural models, however, do not seem to be in much favour with the Royal Academy, for instead of making suitable preparation for them, it seems to treat them as little better than lumber, that may be huddled together any how. Whether it ever turns away any things of the kind, we know not, but we certainly have seen many that have never been exhibited there, probably because it is pretty well known to architects that they would be considered unwelcome guests. But we must not say too much, or next year we shall have the Academy provide accommodation for models, by fixing up a shelf for them, on each of the rooms, at about a foot from the ceiling.

We have already observed that there are this season fewer subjects than usual which afford us any information as to public works or improvements actually in progress—with the exception of churches, almshouses, and union workhouses. Two drawings, however, there are which show us the additions now making to the buildings of two of the inns of court, viz., No 1252, "South-east view of the hall

[2] "The Churches of London," vol II

and library, Lincoln's Inn," P. Hardwick, R. A., and 12 2, "View of chambers now erecting in the south court of Staple Inn," Wigg and Pownall. The first of these will be a handsome structure, somewhat similar in style and character to Middle Temple hall, and will, like that, be of red brick and stone. The building at Staple Inn, which is now considerably advanced, is also of the same materials, but there the colour of the brick is white, owing to which there is certain flatness and want of relief, the difference as to colour being just enough to disturb uniformity without producing decided and intentional contrast. The style itself is Elizabethan, of a sober cast—perhaps somewhat too much so, and so as to lose some of that character which is what chiefly recommends that style for imitation at the present day. In this instance we think it would have been an improvement had the lower windows been made slightly projecting bays, since that would have thrown a little more variety into the composition, and would have produced a sort of balance as well as contrast with the circular bow-windows over the doorways.

No 1332, "The Amicable Life Assurance Office, built to be erected in Fleet Street," S. Beazley, makes us acquainted with another improvement, but one on so small a scale that it is not likely to produce so much show in reality as it here does upon paper—and even so seen, it is what would be passed without notice, but for the information relative to it contained in the catalogue. The new building at the corner of Water Lane, on the same side of Fleet Street, is a very much better piece of design, yet even that is so mere a piece in itself, that it looks no better than the commencement of a facade intended to have been carried on as far as Bouverie Street—had such been done, it would have formed a striking architectural object. As an improvement in general street architecture, may be mentioned No. 1233, "The intended new frontage of Freeman's Court, City," J. Anson, which, however, except as such, is not at all remarkable, since it consists merely of a uniform range of buildings in red brick, with stone dressings to the windows, somewhat similar to the front of the new office of the *Morning Post*, in Wellington Street North. Of "street architecture," much more dignified in character than anything we are accustomed to, or due even to look forward to, we meet with an ideal specimen in No 1259, which is so massive [illegible] in style, that its author (A. Batson) will be considered quite a visionary. Regent's Park palaces and the architectural grandeurs of Pimlico, must hide their diminished heads, and sink into utter insignificance, if in the course of the extensive improvements we are promised in the city, we are to have any street—or even a single front of such [illegible] pomp and stateliness. This drawing is also a very remarkable one in itself, energetic, but exceedingly vague and sketchy—a one like the first conception of a painter than the distinctly defined idea of an architect, on which account it may perhaps strike the imagination all the more, by leaving a very great deal for the imagination to work upon.

On turning from this subject—whose title in the catalogue would never have led us to search for it—to some of the designs which we had look out for as promising something by their names, we feel rather chilled. While not a few of them are disappointed us when discovered, others are put where, when found, so little can be seen of them, that it would be hazardous to attempt to pass any opinion on them, because they may be either very much better or considerably poorer than they look at a distance. Such is the case with No. 1217, "Design for the proposed Exchange, Manchester," of which we can only say that if it is shown to advantage by being placed where it is, nothing will be lost should it never be seen any nearer, and should it never be beheld in any other shape than that of a drawing. We may, however, have missed several things of merit, more or less, which may deserve to have been placed in situations now occupied by very inferior productions. We have, in fact, neglected to mention several drawings—not because they are unworthy of notice in themselves, but because some of them do not offer much for remark of any kind, and of others our recollection is now not sufficiently distinct. One rather striking architectural subject—how far it is portrait or original composition, we do not know—is No. 1229, "Stone church in the palmy days of the 14th century," A. Smith, a splendid interior, well calculated to find favour in the eyes of those who hope that the devotional pomp of those same "palmy days" may yet be revived among us. In the meanwhile it is consoling to find that even should we not recover Popish puppet show again, we are beginning to pay due attention to architectural decorum and character in our Protestant churches. Of such being the case we meet with a proof in No. 1260, "Interior of the new church of St. Mary, Herne Hill, Dulwich," G. Alexander, which though by no means showily, is consistently decorated, and the style, good in itself, is well kept up in every respect. There are some good designs for almshouses, although not the very best of them, nor equal to Nos. 1265 and 127 , No. 1223, "Asylum for journeymen tailors, part of which has been lately erected at Haverstock Hill, Hampstead," is better than usual.

It is looking at this year's architectural collection as a whole, that we are dissatisfied with it, and not least of all so because it manifests an indifference on the part of the profession which contrasts strangely with the increased attention now given to the subject of architecture by the public—if not as yet by the public generally, by a very much larger class of it than formerly. If we ought to be satisfied with as many productions of interest and merit as we now actually find here, and consider them as forming of themselves a very creditable exhibition, we could also be satisfied with them alone, at any rate could very well dispense with a great many which only add to the numbers in the catalogue, without contributing at all to the character of the architectural part of the exhibition.

THE SELF-REGULATING EXPANSION SLIDE VALVE.

Sir—In the description of my self-regulating expansion slide valve, inserted in the *Journal* for February last, I inadvertently committed an error, which your Glasgow correspondent has very properly pointed out: this circumstance having given rise to a mistaken notion as to the efficacy of the principle on which this valve is constructed, you will, I hope, permit me to correct my former mistake, and to make a few observations through the medium of the *Journal*.

The erroneous statement was this: "*When the points of the tappets [illegible] to hold the plate I, the slide valve H, alone will move,*" &c. The tappets, properly speaking, should never hold the plate, although their doing so would lead to little or no inconvenience, if the plate I, is properly proportioned, because then even admitting the tappets to hold the plate I, as stated, the steam would be cut off so very soon, (at about [illegible] of the stroke of the piston,) that the engine would immediately lose her speed, the governor balls by closing would separate the cams or tappets, and the inconvenience would not be felt. The drawing, Fig 3, being incorrect, the error in the description becomes important, for if, as improperly represented in Fig. 3, the plate I, is only just made long enough to cover the space existing between the passages on the back of the valve, and if the tappets are made so as to prevent that plate from moving with the valve, the steam would be cut off, it is true, at [illegible] of the stroke of the piston, but it would also be re-admitted into the cylinder, when the piston had got within [illegible] of the end of the stroke, and this imperfection would continue to a lesser extent during every other degree of expansion. The plate I, should be sufficiently long to cover half of both passages on the back of the valve.

The following example of a valve as made will fully explain my meaning.

The orifice of the steam port in the face of the cylinder, is three inches, the passage through the valve 1½ inches, and the moveable plate I, made so long, that when placed on the middle of the valve, it half covers the two passages, the cams or tappets are so regulated as never to approach within [illegible] of an inch of each end of the moveable plate, so that the valve will travel 1½ inch before the steam is cut off from the cylinder, and on its way back, the plate I, will cover the passage through the valve, until the valve itself covers the steam port in the face of the cylinder.

For the above valve the stroke must be six inches, and supposing the engine to be on her centre, the slide valve will be in the middle of its stroke.

As long as the tappets remain in the position assigned to them above, the plate I, will cover the passage when the valve has made one half of the remaining three inches of its stroke, which will be effected by the crank pin having described an arc of about 29° 30′, or nearly one-sixth of its half circumference, when the piston will have travelled through $\frac{1}{15}$ of its stroke, *the motion of the valve being as the sine, and that of the piston as the versed sine, of the arc described by the crank pin.* Therefore, under the above circumstances, steam will be admitted during $\frac{1}{15}$ of the stroke of the piston, and as the distance between the points of the tappets is increased by the action of the governor, so will the quantity of steam admitted to the cylinder be also augmented.

When, therefore, the plate I, is made of the length above-mentioned, the steam may be cut off at $\frac{1}{15}$ of the stroke of the piston, but as it is seldom required to cut the steam off so soon, the portion of the length of the stroke during which the steam may be admitted, can be augmented by diminishing the length for the plate I—as for instance, if it is desired to cut the steam off at one-sixth of the stroke, it will suffice that the plate I, should be made long enough to

cover only one fourth of the passage at each end of the valve, and for any other portion between one-sixth and $\frac{1}{12}$ of the stroke, during which it may be thought requisite to introduce the steam as a minimum, the plate I, must be made of a sufficient length to cover some intermediate portion of the passage, between one-fourth and one-half.

Under all circumstances, the distance between the points of the tappets at their nearest approach to each other, should be equal to the length from outside to outside of the two passages that run through the slide valve, and the governor should be so applied as to give to each tappet, a stroke equal to one-fourth of the total stroke of the slide valve.

Your Glasgow correspondent says that "*a slight examination of the drawings will show that though the steam is cut off as soon as the port of the cylinder is half open, admitting steam during rather less than one-fourth of the stroke*" this is an oversight on his part, and a closer examination of the drawings, imperfect as they are, will convince him (every thing being as shown in the drawings,) that although the steam would be cut off as soon as the port of the cylinder is half open, it would only be admitted into the cylinder during about *one fifteenth* of the stroke of the piston, instead of something less than one fourth.

It remains for me to thank your correspondent for having called my attention to the error I committed in my former communication, and as I fear that I have already too much trespassed on your valuable space, I shall be happy to answer any questions, or give any information in my power, if your correspondent will send me his name and address. I was not in England when the *Journal* for May appeared, or I would have requested the favour of your inserting this in your last number.

I remain, Sir,

Your most obedient servant,

London, June 8th, 1843. H. H. EDWARDS.

THE BUDE AND BOCCIUS LIGHTS.

During the last month two of the Wednesday Evening meetings of the Society of Arts, in the Adelphi, were occupied with the reading of interesting papers describing the Bude and Boccius lamps and their advantages. On the first evening the large room was splendidly lighted from one gas lamp, suspended from the centre of the room, on the Bude principle, when Mr. B. then read a paper and described its principle. On the following Wednesday the room was lighted in a similar manner with the Boccius light, when a paper describing its advantages was read by Dr. Atkin. We have here given a full description of each light by the respective authors of the papers, and leave it to our readers to judge of their respective merits. They both appear to be deserving of encouragement and the patronage of the public.

THE BUDE LIGHT.

The Bude light is the invention of Goldsworthy Gurney, Esq. of Bude, in the county of Cornwall, and has been called *The Bude Light*, a name given to it at the Trinity House to distinguish it from Mr. Gurney's former invention. Mr. Gurney has, for the last twenty years, been experimenting upon the best means of producing the most powerful and beautiful light. In 1822, he invented the light called the Oxy-hydrogen Light, which he fully explained in his lectures delivered in Cornwall in 1822, and published in his book on chemistry in 1823. This light was the result of his experiments with the oxy-hydrogen blow pipe. The combustion of the two gases, oxygen and hydrogen, issuing from two distinct jets in certain proportions, produce no light, and only a small blue flame giving off very great heat, but when a small cylinder of lime is placed behind the jets the most intense and beautiful light is evolved. Some years afterwards Mr. Gurney invented another powerful light, produced by passing a stream of pure oxygen gas through the wick of an oil lamp, whereby a most intense and beautiful light was formed. This light was put up at the Trinity House, where it was seen by Mr. Hume, who was the chairman of the lighthouse committee; he introduced it to the notice of the House of Commons, and it was subsequently adopted for lighting that house. Difficulties occurred in the practical working of this light, and Mr. Gurney determined on still further prosecuting his experiments, and the result was, the production of what may be called *The Atmospheric Bude Light*.

The mechanical principle by which the light is produced, consists of a series of horizontal concentric rings of tubing perforated on the upper part for the escape of the gas placed at definite distances from each other, and so arranged as to regulate the quantity of atmospheric air, and to communicate by conduction and radiation sufficient heat to raise the temperature of the gas to a given point, so as to effect the separation of its carbon immediately as it leaves the burner, and then by an arrangement above to bring fresh atmospheric air to the proper points of the flame. A perfect lamp will deposit the carbon in the flame the instant it passes the jet. If so imperfect as to deposit too soon, carbon will be found in the rings; if too late, then high up in the flame. There is a point of accuracy required, which practice has determined. This mechanical arrangement brings about a series of chemical changes involved in the evolution of light and heat, which are very interesting. The rapidity of chemical union governs the respective quantities of heat and light. We may by a too rapid combination produce heat alone, and no light. It has been found by careful measurement, that little or none of the light given off by the inner rings is lost, but that it all passes through the outer rings of flame. By the concentration of a mass of light, a powerful illuminating effect can be diffused over the whole apartment, and may be softened down by glass shades to any intensity, and tinted, if desired, with any colour. It has been found in the shops in London where this light has been used, that its effect on coloured articles is very different to other artificial lights, as all colours—particularly blue and green—can be as distinctly seen by it as by daylight.

Its economy has been proved to be very great. The evidence given by the scientific gentlemen examined before the committee of the House of Commons, they proved that for the same quantity of light used in that house, the saving by using the Bude burner is equal to 50 per cent. Professor Wheatstone stated that the Atmospheric Bude burner he used had 3 concentric rings, and was supplied with street gas. Its light was equal to 68 wax candles, and consumed 20 cubic feet of gas per hour. The Argand gas burner used by him was equal to ten wax candles, and consumed 5 cubic feet per hour. The Bude Light consumed not quite four times the quantity of gas which the common gas burner did, whilst the light given by it was 6½ times more intense, thus giving an economical advantage of the Bude light over the gas light of very nearly double.

The committee in their report to the House state that the saving effected upon the lighting of the house by the introduction of this light was 484*l.* 9*s.* per session. The light has given the greatest satisfaction. Its intensity combined with its softness has delighted all the members of that house. Its effect in the different churches where it has been placed is most excellent. Clapham church is lighted by one burner, which is composed of 5 concentric rings, the diameter of which is 11 inches; this lights the whole church very beautifully, and so perfectly, that the congregation is able to read in the shadow near the pillars supporting the galleries. In Christ church, Albany street, a more perfect illumination has been produced by two burners than by the 72 Argand burners previously used there. But one of the most important advantages of this light is, that it proves a most perfect ventilator. It is always fixed high up in the room with a large escape pipe over it leading to the chimney, or externally entering, which carries off all the products of the combustion of the gas; without this pipe it is not considered that London gas can be pleasantly burnt.

THE BOCCIUS LIGHT.

The burner of the Boccius Light consists of one or several concentric rings, when more than one is used, the inner ones rise to a higher level than the outer, as shown in the annexed engraving B B, and are perforated with numerous minute holes in about the proportion of 60 to a circle of an inch in diameter. The inner are supplied with gas from the outer, and to make up for the diminished supply the holes in the inner are rather larger. Above the burner at a given distance two concentric metallic chimneys (D) are placed, whose diameter is regulated in great measure by that of the outer ring. The chimneys are supported by three wires (C) upon the glass holders, and surrounding the whole, a glass funnel (E), proceeding from the level of the burners to the top of the metallic chimneys. The glass in the smaller burners is perfectly straight, in the larger ones slightly bell shaped at the bottom. When the gas is turned on and lighted, the lower part of the burner—that is, the rings (BB) and crutch (A) become to some extent heated, and communicate a portion of their heat to the ascending gas; the amount of heat is from the construction, accuracies having been attained by experience, so nicely adjusted that no carbon is deposited in the ring, but the warm gas escapes in a state to deposit its solid matter on a slight increase of temperature. The cold air too in rushing between the crutches and rings becomes warmed, and the burner is thus supplied with hot air, no air being admitted except from the bottom; it, of course, can produce but a very insignificant cooling effect on the flame. The chimneys, especially the inner one, robs the ascending current of a great portion of its heat, which it in turn communicates to the upper part of the flame, and carries the particles of carbon there to an intense temperature, and causes them ultimately to unite with oxygen. The quantity of air entering is so regulated by the size of the separate openings, that it produces nearly a perfectly cylindrical, instead of a conical flame. From some cause or other, the reason of which the inventor is unable satisfactorily to explain, the products of combustion are separated from one another, and appear at different positions. The ascending current of air between the glass and outer chimney supports combustion, as of a taper, when placed between the two chimnies the taper is extinguished, and re-lighted again when brought over the central aperture. The novelties in arrangement of this lamp are the rising concentric rings and the metallic chimnies. We have in the engraving represented a large double ring burner in the centre, the diameter of the outer ring is 5 inches, and of the inner, 3 inches. This size burner will consume about 55 feet per hour, and be equal to 22 Argand burners, consuming 5 feet per

hour, or 110 feet, the saving is, therefore, one half These burners have been subjected to the most severe scrutiny, they have been examined and tested by some of the most expert experimentalists and have passed the ordeal and all who have had an opportunity of examining and proving them, concur in awarding to them the highest praise The Boccius light has been introduced in the [illegible] gham Gallery where both the features and statues were better seen by it clear than an obscured light The students there (and, perhaps on such a point their evidence is of value), state they can draw as well by the [illegible] of the Boccius light as with daylight the shadows being as perfect as those produced by sunshine Mr Moxon's Hall of Commerce [illegible] street is illuminated with this light It has also been erected at [illegible] Cross for some months where it brilliantly illumines that [illegible] for a considerable distance The advantages which the patentee proffers to the public and proves his light to possess are

1st Obtaining the greatest quantity of light from the least quantity of gas

2nd [illegible] the trifling amount of [illegible] produced

3rd From the same cause the comparatively small amount of heat generated

4th From the complete combustion, the impossibility of escape of the noxious [illegible] gas into the air

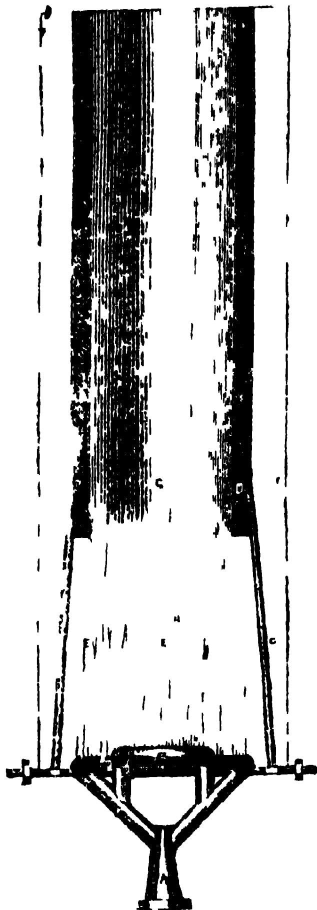
5th The complete absence of soot and smoke

6th The durability of the apparatus and the ease with which it is managed

7th The possibility of applying with success the principle to burners of all [illegible] 1 foot to another consuming 100 per hour

8th The easy mode of ventilation it affords either by placing a vent [illegible] in the roof [illegible] above the light [illegible] communicate with the air

The light may be seen at any time at the office of the patentee [illegible]



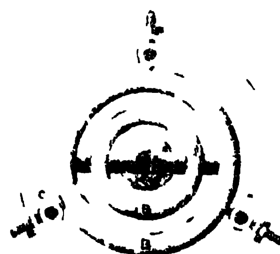


Fig 1—Section Fig 2—Plan

[illegible] formerly lighted by 30 bats wings consuming 1,000 feet an hour [illegible] 3 Boccius burners consuming 225 feet an hour [illegible] the stationary room was, also lighted with one [illegible] instead of 22 bats wings which used to [illegible] 110 feet an hour

PATENT SAOTAPE NOSING

Patented by Arthur C Tupper

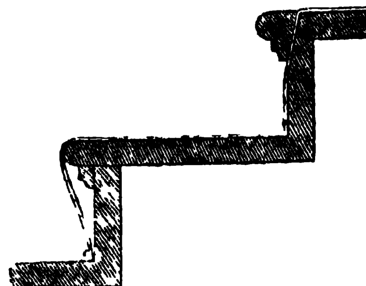


Fig 1

The improvements in laying down carpets, and other materials upon stairs and steps, and in the construction of stairs and steps, and for which Mr Tupper has obtained a patent, may be arranged under two heads the Nosing and Stair Rod In staircases in present use, and where landlords will not go to the expense of having new nosings Mr Tupper proposes cutting through the tread obliquely close to the nosing, as shown in Fig 1 and in the slit so made the carpet passes through To insure support it is proposed that the stair rods be made of an arch like form as shown in Fig 2 with the



Fig 2

[illegible] while the means also of preventing the stair rod from bulging and getting out of the [illegible] arch stair rods are capable of being ornamented to any extent

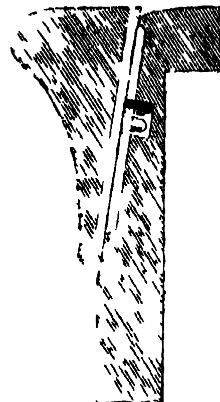


Fig 3

The separate nosings can be made not only of wood as wainscot mahogany &c but also of [illegible] iron brass &c and these can be applied to stone and wooden stairs As regards the fixing Mr Tupper proposes using a wrought iron stud and plate but this can be effected also by screws bayonet joints, rings grooves &c so that the carpet &c can be either placed and the nosing applied over it or the nosing moving on hinge can lift up and the carpet be placed as usual The nosing so applied not only preserves the carpet from the wear caused by the attrition of the feet but also takes up less of the fabric used, as there is a saving of about 2 inches of carpet upon every stair This method also prevents the carpet from wabbling about and here it is especially useful in winders and angular stairs In these moveable nosings two or more pieces of metal can be attached which can be ornamented to any extent and fastened in such a manner, as when the nosing is fixed in its place the carpet is firmly clamped by these "stays," doing away in this case with stair rods and eyes It is presumed that the appearance of a staircase will be greatly improved by this method as the nosings can be ornamented and decorated in various ways, for instance, if a mansion is of the Elizabethan age, the nosings as well as the bannister and handrail can be arranged in the beautiful style of that period

An enlarged model showing a variety of methods of forming the nosing is exhibited at the Polytechnic Institution

Launch of the Steam Frigate Infernal —Woolwich June 1—This beautiful first class steam frigate was built on the same slip in the dockyard as her sister the *Devastation* which has given such great satisfaction owing to her seaworthiness and other qualifications and was launched on the 31st of May

The following are the dimensions of the *Infernal* —

	Feet	Inches
Length between the perpendiculars	180	0
Length of keel for tonnage	156	4½
Breadth extreme	36	0
Breadth for tonnage	35	8
Breadth moulded	35	0
Depth in engine room	1	0

Burden in tons, old plan, 1058

Burden in tons, new plan 1027.

ON THE DECORATION OF THE NEW HOUSES OF PARLIAMENT.

[The following article is an abridgment of a paper which appeared in *Fraser's Magazine* for May last.]

The destruction of the ancient edifice was felt to be a national calamity. The rebuilding another upon its ruins is the greatest architectural work of modern times, and now that it advances towards completion, we naturally turn our thoughts on its embellishment.

With this design the House of Commons appointed a committee in 1841; and, on the 24th of November following, commissioners were nominated by Her Majesty, "For the purpose of inquiring whether advantage might not be taken of the rebuilding of the houses of parliament for promoting and encouraging the fine arts."

The commissioners have now published their first report. It is composed with care, and contains valuable information. Yet, in their projected plan of decoration I see, with regret, that the commissioners have stumbled over the very threshold of their duty.

Justice to those gentlemen demands, however, that their plan should be stated in their own words.

They say:—"We beg to report our opinion that it should be expedient that advantage should be taken of the rebuilding of the houses of parliament for the purpose of promoting and encouraging the fine arts of the United Kingdom.

"With this view we have, in the first place, directed our attention to the question, whether it would be expedient that *fresco painting* should be employed in the decoration of the new houses of parliament, but we have not been able to satisfy ourselves that the art of fresco-painting has hitherto been sufficiently cultivated in this country to justify us in at once recommending that it should be employed. In order, however, to assist us in forming a judgment on this matter, we propose that artists should be invited to enter into competitions of *cartoons*.

"As fresco painting has not hitherto been much practised in this country, and as, therefore, candidates for employment in that mode of painting, whatever their general skill may be, will probably find it necessary to make preparatory essays, her majesty's commissioners think it expedient that *the plan which they have resolved to adopt in order to decide on the qualifications of such candidates should be announced forthwith*.

"Three premiums of 300*l* each, three premiums of 200*l* each, and five premiums of 100*l*. each, will be given to the artists who will furnish cartoons which shall be respectively deemed worthy of one or other of such premiums, by judges to be appointed to decide on the relative merits of the works. The drawings to be executed in chalk or in charcoal, or in similar material, but without colours.

"The plan which may be adopted in order to decide on the merits of the candidates for employment as oil-painters, and as sculptors, will be announced at a future period."

Further, the commissioners determine that the subjects of these cartoons shall be chosen from English history, or from the works of Spencer, Shakspeare, or Milton.

In the consideration of this plan, I do not presume to instruct the architect, the sculptor, or the painter, but I address myself to the public's feeling, taste, and sense, by which this plan, with the works executed under its authority, must eventually be approved of or condemned.

The royal commissioners were nominated for two objects: first, to consider of the decoration of the houses of parliament, and secondly, of the promotion of the fine arts of the United Kingdom.

Let us then examine how these objects are to be attained by the plan proposed.

The first and principal end is undoubtedly the adornment of the seat of the legislature by works worthy of the edifice, the nation, and the age. While instrumental and auxiliary to this, the fine arts of the country were to be employed, and by employment, to be encouraged.

Now the plan proposed inverts this design, for it forgets what is due to parliament in its eagerness to introduce a special branch of art. It gives "the first place" and consideration to painting in fresco, while it admits this art not to have been sufficiently cultivated to justify its immediate employment.

In the useful, no less than in the ornamental arts, we see by daily experience, that the less the practice, the more the risk of failure.

But in this mode of painting hitherto unpractised, where every part has yet to be learned, and can be learned in no other way than by long experience and repeated trials, failures in the beginning are not merely probable but unavoidable.

Are the walls of parliament a fit place for the trial of a new art?

Are the 'prentice hands of painters to be employed, where nothing ought to be admitted but what is of the highest excellence our arts have attained to?

Is parliament, I demand, to be made the "*experimentum in corpore vili*?"

This were to sacrifice the end to the means—the embellishment of this national edifice to the patronage of a new art—certain to disgrace what it meant to adorn.

The second object of the commission was to promote the sculpture and painting of our country.

Consider, next, how this "Plan" can promote them. It attempts to introduce a branch of art practically unknown, or known only by some poor failures.

To this "the first consideration" has been given. To this are offered premiums and employment. Meanwhile, all other branches of art are to be postponed, and the "Plan" as to them is to be announced at a future period.

Now how can this unknown mode of painting promote those wherein our artists practically excel?

If the preference be given in the hope that, with the advancement of fresco-painting, historical painting will follow, then the plan overlooks an essential condition, namely, that such a result must be the work of time—probably of ages. Whereas, the commissioners were nominated for a special purpose—the decoration of the new houses of parliament, now in progress towards completion.

Is it wise, then, to postpone all those forms of art in which we actually excel for a distant and doubtful a result? Or do the commissioners expect artists of established reputation will take up a new branch of painting, beset with difficulties, even in the material on which they are to work?

What man of sense would risk a well-earned fame by a public exposure where failure is certain?

The preference, therefore, given by this plan to fresco-painting, will tend to exclude men of distinguished merit, and thus narrow competition to such as have yet a name to gain; possibly modest men of skill, more probably, bold adventurers ready for any job.

Or it may exclude entirely our native artists, to throw employment in the hands of foreigners, eagerly on the watch to grasp at the occasion.

Still the contradictions between this "Plan" and its professed purposes are forgotten in the absurdities that mark its manner of execution. The commissioners evidently mistrust their favourite project.

"They are not satisfied that fresco-painting has been sufficiently cultivated to justify them in recommending its employment.

"They admit that artists whatever their general skill may be, will probably find it necessary to make preparatory essays."

Here is a difficulty, indeed, and how do the commissioners get over it?

They offer £2000 divided into eleven premiums, for the best cartoons or drawings "in chalk or in charcoal without colours." These drawings are to serve the double purpose of "preparatory essays," and to enable the commissioners, or those they shall nominate, "to judge of the qualifications of candidates."

Let us pause here for reflection. Have the commissioners ever seen or heard of any art, introduced and brought to such eminence as should fit it for a great national work by mere "preparatory essays?" Have they forgotten that this very art of painting in fresco attained its excellence in Italy by the genius and labours of successive generations? Do they not see that they are setting artists to work without masters to show them where they will encounter, and how they are to overcome, the endless difficulties that beset the fresco-painter at every step?

The commissioners strive at what is unattainable. For no branch of painting ever has attained excellence, without genius to invent, labour to execute, masters to teach, models for imitation, schools for the principles, and practice, and time, that in art extends through ages for the accomplishment.

In the place of all these stand "Preparatory Essays." What, then, are those preparatory essays that are to work such marvels, whereon £2000 are to be expended, at once designed to teach artists how to paint in fresco, and the commission is to judge of their ability? Are they to be paintings in fresco? No. For this were impracticable, unless walls had first been built, and plastered to practice on. Are they to be paintings at all? No: they are to be merely "drawings in chalk or in charcoal without colours."

Now will the commissioners condescend to inform the public how drawings upon paper or canvass are to teach the art of painting on plaster? The drawings may possess every quality of design, yet their designers be utterly incapable to paint them in fresco. Suppose, for instance, that Raffaelle's cartoon of the "Schools of Athens" were placed in the hands of an unpractised artist, is there any one so

simple as to believe that, presently, he would be invested with ability to paint the famed fresco on the Vatican? It is true the drawings will show the choice of subjects and manner of treating them, but they will show no more. They cannot prove the artist's power to transfer, embody, and permanently fix his colours into a material so untractable and capricious as a plastered wall.

Whoever, like myself, has watched the slow progress of a fresco-painting, from the "tracing" to the last touch, knows well that it is a process beset with difficulties at every step, unknown in other branches of the art, and to be learned and overcome by years of patient labour. Yet upon this false notion the commission is have resolved to rest their judgment, and expend £2000.

What motives could have induced the Italian masters to have persisted in the use of a material so unmanageable, capricious, and perishable as stucco; at the best but a cheap and mean imitation of marble? To answer this question, we must consider the various materials used as grounds for painting. These have been vellum, paper, glass, ivory, marble, porcelain, copper, panel, canvass, and stucco. For works of magnitude, the three last, panel, canvass, and stucco, have superseded the rest. They were simultaneously used. But in the early times of oil painting, panel was preferred, not only for its durability, but because it enabled the painter to enrich his figures with inlaid jewels, pearls, and gold, agreeable to a custom transmitted from remote antiquity. Though subject to rend, to warp, and to be worm-eaten, panel is the most durable of these three substances. The oldest works in the best preservation are those on panel. Many are yet extant, on which 300 years have wrought no visible decay.

Canvass possesses many peculiar qualities as a ground for painting. It may be woven of any size and texture, it is light, cheap, and easy of transport, for we must not forget that paintings form an article of commerce. It may be stretched if shrunk, and what is truly admirable, when rotten or worn out, it may be severed from the painting, and replaced by new; an invention that has bestowed upon canvass paintings the durability of those on panel, and has thereby saved from crumbling to dust many precious works. Light, then, as the fabric is, canvass paintings have lasted for centuries, and if frescos are older, it is not that stucco is fitter to preserve them, but because painting in oils was an art invented or recovered in later times. Having these substances in daily use, the question then returns, what motives could the Italian painters have had for persisting to paint on stuccoed walls, while some are said to have preferred them.

Let us next proceed to the inquiry, in what manner sculpture and painting may be most suitably employed in adorning the magnificent seat of our legislature, by works worthy of its destinies, of the empire, and the age.

Whoever will be at the pains to fully reflect upon this subject will find himself drawn to the conclusion, that these objects are not to be attained otherwise than by the employment of those branches of the arts wherein we have already attained to excellence. Now the sculptors and painters of our country possess unrivalled pre-eminence throughout Europe for statues and portraits. But here the question comes, are statues and portraits the most suitable decorations for the houses of parliament? We shall find the answer in the customs of mankind. No custom whatever in the fine arts have I met upon has been more anciently or generally established, than for halls of council to be adorned with the effigies of illustrious men.

In the free states of Greece this custom served as the memorial, the reward, and the incentive to noble deeds.

In Rome it rose to the dignity of a political institution, placed under the jurisdiction of the senate. Whence it was copied by the municipal councils of that empire. The nations who formed kingdoms out of its conquered provinces preserved the usage whenever their arts would permit. The Italian renown's give the custom the sanction of law. Undoubtedly, then, such a custom must have been in harmony with the feelings of free nations. Still more is required. The custom ought to be congenial to the habits of England. Let us recall what we possess in this sort. We see in Westminster, in the cathedrals, even in the parish churches, how rich England is in monumental statues, and how charmingly they harmonize with architecture.

In our ancient cities where is the council-chamber without portraits of honoured citizens? Where is the college-hall unadorned with the likenesses of its founders and benefactors? Where is the ancient mansion without its family gallery?

The custom, then, is truly English. Shall a usage so honoured, interwoven with all we hold dear, find no place in parliament, where are concentrated the ranks, intellects, and feelings of the country? Shall its adoption by the senates of antiquity whose attainments in the fine arts we are now vying to emulate, be of no weight, not even to prefer the memorials of departed worth to the projects of unknown men?

In sculpture and painting it will be found that the likenesses of the renowned dead affect the feelings more deeply and lastingly than the loftiest creations of fancy, even when their subjects are chosen from actual events.

A comparison taken from the highest works of art will best explain this principle. Whoever has resided at Rome may have seen the frescos of Raffaelle in the Vatican, and probably passed onward to the gallery of statuary where are arranged the sages and statesmen of Greece. In the frescos are seen the designs of the loftiest genius expressed with consummate art. In the statues are seen in the cold marble the features and expressions of those mighty men of old whose names have been familiar to us from boyhood, whose fame still fills the world, perchance whose intellect may have guided our own.

The paintings charm and excite, the statues calm the feelings, and lead the mind onward through grave trains of thought. Which of these conditions is most suitable in senates and courts of justice?

Nor is this difference due to the contrast of painting with sculpture, for substitute portraits for statues, and we may observe a similar effect. Both are triumphs of simple truths long treasured in our minds, over the utmost powers of invention.

And here I cannot let slip the occasion to remark, that France and Germany are now employed in reviving this wise and noble custom of antiquity, each applying it to their respective conditions. France has devoted the deserted palace of Versailles to place the statues and portraits of her illustrious men, and by this act the present generation has done their utmost to repair the ravages of the last.

The plan is admirable for comprehension and arrangement. There are seen the kings, warriors, statesmen, presidents of parliaments, and whoever was renowned in times authentic and known, all classed and arranged.

The Walhalla, erected by the king of Bavaria, is a similar design to commemorate the renowned men of Germany.

I do not cite these national works as models to be followed by England, but as proofs how the spirit of antiquity still lives in modern times.

These principles stated, I submit the following outline of a plan, for an outline is all that can be offered, yet distinct enough for precise ideas, which failing to satisfy the judgment may perhaps hereafter serve for some happier suggestion.

1. The subjects for sculpture and painting should be chosen from the constitution of parliament itself, and in a manner to illustrate its history.

By a gallery of the kings of England represented in statues of marble, arranged in the order of time.

For in all ages, in fact as in law, the sovereign has been the "*primum et finis*" of our parliaments.

The series should begin with Alfred, as founder of the English monarchy, by union of the Saxon states under his sole dominion, and as his memory is revered, for the wisest and best of that long illustrious line by his successors to the throne, who claim him as their common ancestor.

Of the later Danish and Saxon kings, most of whom are known only by name, a selection should be made; and Athelstan and Canute merit to be preferred. For the former, by arms and treaties, united Great Britain under one supreme sovereignty, leaving the more distant provinces under the immediate rule of their native princes and laws; an event that imperial Rome had contended for in vain during 300 years. And the latter was the most powerful monarch of his age; under him the rival races of Saxons and Danes were united by equal laws.

From the conquest until the reign of her present majesty, a statue should be erected to each sovereign.

2. I propose that an historic gallery be formed in portraits of the most distinguished members of the House of Peers, arranged in the order of time, less to commemorate individuals than to illustrate the institution—in former ages, the guardian of public and private rights against the usurpations of monarchy; in our own, against those of the populace, holding the balance between custom and change, principles that contend for the government of society.

3. I propose a similar gallery of portraits of those who have been the most distinguished members of the commons.

The series must begin with the reign of Elizabeth.

Lastly, adhering to the constitution of parliament, another gallery falls to be added of the most eminent judges of the land.

In fine, this plan consists of historic galleries to be formed from past and future times. And as the age is more distant from our own, the easier will the choice become, for then it will be guided by established renown.

THE FRENCH AND BELGIAN RAILWAYS.

We are indebted for the following interesting and valuable paper to Mr. Flanigan, a young engineer of considerable talent, who has of late had much practice both in Belgium and France, in estimating and superintending engineering works; it is a document which shows with what minuteness the continental railway engineers prepare all their details, and likewise gives some idea of the cost of railway works on the continent. The scale of prices is low, as the tender which was accepted only allowed half per cent off the schedule.

The method of proceeding with contracts for public works in France and likewise in Belgium, is in the following manner. The engineer of the line prepares his contract drawings, which are executed with great minuteness—he then prepares a schedule of prices in detail, and the quantities of the works necessary to be done on the line as per annexed list. Tenders are then advertised for. The parties tendering have to state what per centage he will take off from the schedule of prices, not upon any individual price but upon the whole; this method is analogous to the form of tendering for works to be done for the Ordnance and Government in this country. After the tenders are received they are immediately taken into consideration, and the party whose tender is accepted is called in and informed of the result, an appointment is then made with the engineer and contractor to go over the country of the proposed line of railway, which the engineer describes to the contractor, and at the same time furnishes the latter with a bill of quantities priced out according to the schedule of prices, after going over the line, the contractor is allowed from fourteen to twenty days to examine the quantities, and if no error greater than one-sixth can be discovered the contract is considered binding, but if any error is discovered an allowance is made, but after the contract is concluded, at the end of the fourteen or twenty days as the case may be, it is binding upon the contractor, notwithstanding any error may be found out afterwards. We should also state that the contract is subsequently sent to the minister of public works, who has the sole power of rescinding it if he thinks proper.

In this translation the French measures and currency have been retained. They may easily be reduced to their respective values in this country by taking in round numbers the cubic metre as equal to $1\frac{1}{4}$ cubic yard and the franc as equal to 10*d.*, thus the first figure in the decimal part represents as many pence as it has digits. The lineal metre is nearly 3 ft. 3 in.

BASIS OF THE PRICES.

WAGES PER DAY.

	Not including tools & profit of contractor.	Including tools & profit of contractor.
	fr. c.	fr. c.
Navigator for getting and filling	2·95	3·25
Navigator for wheeling ..	2·15	2·48
Stone cutter and setter .	4·00	4·62
Assistant stone cutter and setter	3·00	3·47
Ordinary mason ..	3·00	3·47
Labourer	2·50	2·89
Superintendent of mortars and betons	3·00	3·47
Carpenter, sawyer, and joiner	4·00	4·62
Paviour	4·00	4·62
Assistant paviour ..	3·50	4·04
Smith	4·50	5·20
Assistant smith ..	4·00	4·62
Painter	3·50	4·04
Slater	4·00	4·62
Assistant slater ..	2·75	3·18
One horse and cart including driver	7·00	8·09
Two horses ditto	12·00	13·86
Three horses ditto	17·00	19·64

1st *Division.*—EARTHWORK.

The earthwork to be measured in the cuttings *per cubic metre.*

No. 1 – *Getting and Filling*; or one spade's throw every kind of soil and every thing included, per *c. m.*

			fr. c.
In transverse section, No. 1 to 14		..	0·65
Ditto	14 to 108	.. .. ..	0·46
Ditto	108 to 356	.. .. ..	0·59
Ditto	356 to 470	.. .. ..	0·46
Ditto	470 to 581	.. .. ..	0·44

N.B. These prices for getting and filling will be applied without any exception, and without its being in the power of the contractor to demand any other classification than the above.

No. 2.—*Wheeling* for each relay or run of 30 metres on a level, or of 20 metres on an incline of 1 in 10, per *c. m.* . — *fr. c.* 0·12

No. 3.—*Carting* for the 1st relay of 100 metres on a level, or of 75 metres on an incline of 1 in 20, per *c. m.* .. .. — 0·42

No. 4.—Carting every relay after the first, of a 100 metres on a level, or of 75 metres on an incline of 1 in 20, per *c. m.* .. — 0·11

If the centre of gravity of the cutting is on the same level, or higher than that of the corresponding embankment, the distance between the centres of gravity will be taken for the distance of carriage, if the centre of gravity of the cutting is lower than that of the embankment, it will be considered that the difference of level has been surmounted in ascending inclines of 1 in 20 for carts, and of 1 in 10 for barrows, and that then the carriage has been completed on a horizontal plane. The length of lead is taken in the vertical plane passing through the two centres of gravity. It is only when the distance between the centres of gravity is such that it is necessary to divert in order to obtain inclines of 1 in 20 for carts and of 1 in 10 for barrows, that such diversions will be paid for.

The fractions of relays will be counted by $\frac{1}{3}$.

No. 5. *Carriage by Waggons.*—The price will be determined by the following formula

c equal to 2·501 (3D + 3·75R + 2·50C + 300 + 0·0000355 (l + 1·50D + C + 300) + 0·0003897 + 0·122 divided by *m.*

in which

l is the distance between the commencement of the cutting and the extremity of the embankment

D, the length of the cutting

R, the length of the embankment

m, the cubic quantity of earthwork measured at the cutting, to be tipped.

l, the horizontal distance between the centres of gravity of the cutting and embankment

C the length of sidings

The value of the letters which enter into this formula will be fixed for each cutting.

No. 6. *Spreading* of a cubic metre of embankment in beds of 0·15 *m.* to 0·20 in height, trimming and dressing of slopes . — 0·03

When wagons and temporary railways are used, no price will be allowed for spreading, as it is included in the price allowed for the embankments formed in this manner.

No. 7. *Ramming* or *Punning* the embankments in beds of 0·15 *m.* to 0·20 *m.* thick, when the engineer considers it necessary, will be paid for per *c. m.* . .. . .. — ·14

Previous to ramming, the soil must be properly watered.

The rammer must weigh 4 kilogrammes (9 lbs.), and must strike at least four times the same spot.

The engineer reserves the right of having the ramming done at the direct expense of the administration, by day work.

No. 8. *Soiling*, per *c. m.* . . .. — 0·20

No. 9. The picking out and laying aside the rubble and gravel found in the cuttings will be paid for per *c. m* .. .. — 0·25

2nd *Division.*—PAVING THE CROSSINGS AND THEIR APPROACHES.

No. 10.—Siliceous gravel for roads, and beton broken to the required dimensions.

	fr. c.	fr. c.
Compensation for land	0·25	
Picking and breaking the large stones ..	1·70	
Filling ...	0·17	
Carriage to the distance of 2000 metres .	1·61	
Laying aside in heap	0·15	
	3·910	
Tools, &c. $\frac{1}{20}$	0·196	
	4·106	
Profits of contractor, $\frac{1}{10}$	0·410	
Price per cubic metre	4·516	4·52

No. 11.—Breaking stone found in the gravel of cuttings, to the required dimensions of 0·06*m* in every direction

	fr. c.	fr. c.
	0·350	
Tools, &c. $\frac{1}{20}$	0·017	
	0·367	
Profit $\frac{1}{10}$	0·037	
Per cubic metre	0·404	0·40

No. 12. Making macadamised roads, including the dressing and ramming of the bed .. .. — 0·40

No. 13.—*Sand* from the sand pits of Bienl le See and de l'Ecquipee, to be used between transverse sections, No. 1 and 230.

Price at the sand pits .. .. — 0·50

Filling, &c. 0 30
Carriage to the average distance of 1000 *m* [illegible] 21

3 01
Tools, &c. 0 1 2

3 197
Profit 0 320

Per cubic metre [illegible] 3 52
No. 14. From Tequinviller, to be used between transverse section 250 and 330
Price at the pit, filling, &c., as in preceding 0 80
Carriage to the average distance of 6 kilometres 1 01

1 81
Tools, &c. 0 24

[illegible]
Profit 0 [illegible]

No. 15. Sand from the pit of Blir and S[illegible], to be used between transverse section 330 at 1 081
Price at the pit, filling, &c., as in No. 15 0 80
Carriage to the average distance of 4 00 metre [illegible]

[illegible]
Tools, &c. 0 197

[illegible]
Profit 0 41[illegible]

Price of a cubic metre [illegible]
No. 16. Paving stones per thousand from the quarries of Blancourt, to be used between transverse sections No. 1 and 8[illegible]
Price at the quarry
Filling and laying the stones [illegible]
Carriage on average distance of 1[illegible] kilometres [illegible] drawn by 3 horses will make [illegible] trips in 15 days, carrying 84 paving stones per trip

391 [illegible]
Tools, &c. [illegible] 10

417 62
Profit 41 [illegible]

Price per thousand [illegible]
No. 17.—Paving stones from the quarries of [illegible] to be used between transverse sections [illegible] and [illegible]
Price at the quarries 140
Loading and laying them [illegible]
Carriage to the average distance of 10 kilometres [illegible] 3-horse cart loaded with 84 paving stones will make 4 trips in [illegible] days [illegible]

Tools, &c.

317 63
Profit of contractor [illegible]

Price of a thousand stones
No. 18. Paving between transverse sections 1 and [illegible]
18 paving stones at [illegible] per thousand [illegible]
0 25 of sand at [illegible] No. 13
Labour, dressing and ramming the bed [illegible] and profit of contractor 0 [illegible]

Price per superficial metre [illegible]
No. 19. Paving between transverse sections [illegible]
18 paving stones at 349 30 per thousand, No. 17 [illegible]
Sand as in No. 18 0 88
Labour, &c. as in No. 18 0 3[illegible]

Per superficial [illegible] 1
No. 20. Paving between [illegible] transverse section 250 & 330
18 paving stones as in preceding [illegible] 28
0 25 of sand at [illegible] per cubic metre No. 14 1 397
Labour, &c. as in preceding 0 [illegible]

Per superficial metre [illegible] 02[illegible] [illegible]
No. 21 – Paving between transverse sections [illegible] & 081
18 paving stones as in No. 19 [illegible]
0 25 of sand at 1 [illegible] per cubic metre No. 15 1 135

	fr.	fr.
Labour, &c. as in preceding	0 3[illegible]	
Per superficial metre	7 76[illegible]	[illegible] 7
No. 22.—The taking up of a paved road, including the carriage of the old paving stones to the new road to be formed, and the picking and dressing of these stones will be paid for per superficial metre		0 60

2nd Division.—WORKS OF ART

No. [illegible] Oak including carriage, dressing, waste, tools, and profit of contractor per cubic metre		
No. 24. Cradle of oak plank of 0 1[illegible] by 0 0[illegible] to 0 0[illegible] dressed on the banks and used in the platforms of bridges, exclusive of spikes, per cubic metre		90
No. 25.—Oak capping piece for cradle		
Sawing oak	0 60	
Loading, carriage and unloading	0 10	
Dressing and fixing under water	1 20	
11 spikes, weighing together 0 90 kilogramme at 1 30	1 17	
Tools, &c.	0 30[illegible]	
	[illegible] 377	
Profit	0 [illegible]38	
0 0[illegible] of oak, see No. 23, at [illegible]	[illegible] 015	
	7 10	[illegible] 74
No. 26. Pile. Preparing the head, fixing the shoe, and cutting off the pile	1 20	
Tools, &c.	0 12	
	1 32	
Profit of contractor	0 1[illegible]	
Each pile		1 45
No. 27. Oak waling piece for the cradle		
Sawing, answer 1 hour	0 40	
Loading, carriage and unloading	1 50	
Dressing it and fixing it under water to the piles by bolts	21 60	
	23 50	
Tools, &c.	2 [illegible]	
	2[illegible] 8[illegible]	
Profits	2 59	
	28 44	
1 10 of oak, see No. 23, at [illegible]	93 50	
Price per cubic metre		121 94
No. 28. Iron to make the chain for suspension bridge. Iron wire dipped twice in linseed oil including the making of the chain and two coats of paint, the first to [illegible] of red lead, adjusting the chains, every thing included, *per kilogramme*		1 40
No. 29. Oak sheet piling with herring bone joints, *not* including driving		
Sawing oak	0 40	
Loading, carriage, unloading, &c.	0 18	
Preparing the head of the pile, and joints, fixing the shoe, and cutting off the pile	2 12	
	2 70	
	0 27	
	2 97	
Profit	0 297	
	3 267	
12 oak at [illegible]	10 20	
Price per square metre	13 467	13 47
No. 30.—Centres of oak, including the fixing of the centres, and all labour, the oak being returned to the contractor, per cubic metre		[illegible]
No. 31. Every time after the first that the same timber is used, per cubic metre		22
No. [illegible].—Carpentry of oak fixed and dressed, per *c. m.*		130
No. 33. Cast iron *per kilogramme*, (2 2 lb.) cast iron No. [illegible] in bridges, &c.		0 50
No. [illegible]. Pipes of grey cast iron No. 2, of the dimensions prescribed, including fixing, joints, &c.		0 40
No. 35. Iron for shoes of piles		0 85
No. 36.—Wrought iron railing, &c.		1 10

No 37 —Iron for bolts, spikes nails, &c 1 20
No 38 Iron used for leading including charcoal, labour, &c, *per kilogramme* 1 20
No 39 —Solder *per kilogramme* 0 50
No 40 —*Hydraulic lime* per c m
Quick lime at the works, per c m 50
Slacking, whatever be the method employed 1 60

Price for 1 33 m. of slacked lime 51 60
Or for one cubic metre 38 80
No 41 —A cubic metre of *mortar* between transverse sections 1 and 230.
1 m of sand at 3 52 (see No 15) 3 52
0 35 of slacked hydraulic lime, at 38 80 (No 40) 13 58
Labour including tools profit, &c 2 00
19 10
No 42 —Mortar between transverse sections 230 & 330
1 m of sand at 5 59 (see No 14) 5 59
0 35 of slacked hydraulic lime (see No 40 13 58
Mixing &c 2

Per cubic metre 21 17
No 43 Mortar between transverse section 330 & 381
1 m of sand at 1 54 (No 15) 1 54
0 35 of slacked lime 13 58
Mixing and profits 2 00

Per cubic metre 20 12
No 44 *Béton* to be used between transverse section No 1 and 230, per c m
0 80 m of broken stone at 1 52 (No 10) 1 62
0 50 of mortar, at 19 10 (No 40) 9 55
Mixing, carriage ramming &c 3 50

Per cubic metre 16 67
If it be found necessary to use béton between transverse sections 230 and 381, the above will be the price allowed, making the price of the mortar alone vary according to the place
No 45 — *Sand béton* between transverse section No 1 and 250
1 m of sand at 3 52 No 1 3 52
0 15 of hydraulic lime at 38 80 No 40 5 82
Mixing carriage ramming &c 3

Per cubic metre 12 31
This will be the price allowed on the whole length of the contract changing only the price of the sand according to the place where the béton is wanting

Stone per cubic metre

No 46 *Stone* for the two viaducts over No 7 and No 8, and the bridge No 12 over the Pieche
Stone at the quarry of St Maximin, including the use of tools, and profit of contractor 33
Loading and carriage, average distance 21 kilometres 22

No 47 - Viaducts 27 and 28
Stone at the quarry of St Maximin 53
Loading and carriage, average distance 37 kilometres 35
68
No 48 —To be used between transverse section No 1 and 330
Stone (Vergelé) at the quarry at Mello 10
Loading and carriage, average distance 21 kilometres 21

No 49 —To be used between 1 and 330
Stone at the quarry La Gache 50
Loading and carriage, average distance 10 kilometre 11
11
No 50 —Between 1 and 330 (Vergelé
Stone at the quarry La Gache 12
Loading and carriage as in preceding 14
26
No 51 —Same between 330 and 190
Stone at the quarry, as last 12
Carriage, &c average distance 25 kilometres 25

No 52 —Between transverse sections 330 and 190
Stone at the quarry Blancfosse 30
Loading and carriage, average distance 12 kilometres 17
17
No 53.—Between transverse section 190 and 381
Stone at the quarry Laloise 30
Loading and carriage, average distance 10 kilometres

No 54 —Between transverse section 330 and 190
Large hard stone for foundations at the quarry Blancfosse 30
Loading and carriage as in No 52 17

No 55 —Between transverse section 330 and 190
Stone for foundations at the quarry Cannes 20
Loading and carriage average distance 14 kilometres 6
26
No 56 —Between transverse section 1 and 80
Hard rubble stone, at the quarry Bethencourt
Loading and carriage average distance of 3500 m &c

No 57 —Between transverse section 80 and 330
Hard rubble stone, at the quarry Agnetz 1 75
Loading and carriage average distance of 8 kilometres &c
7 75
No 58 Between transverse sections 330 and 190
Hard rubble stone at the quarries Blancfosse 2
Carriage, average distance 12 kilometres &c 8 80
10 80
No 59 — Between transverse section 190 and 381
Hard rubble stone at the quarries Laloise 2 50
Carriage average distance 10 kilometre &c 7 50
10
No 60 Hard rubble stone from between transverse section 215 and 330
Hard rubble stone, at the quarries S[illegible] 00
Carriage, average distance 1 kilometre &c 1 50
6 50
No 61 Between transverse sections 190 and 381
Hard rubble stone, at the quarries Bimont 2 00
Carriage average distance 10 kilometres 7 08
9 08

Masonry

The price of stone for all in the following items No 62 to 69 is calculated from the prices No 46 to 51 with 16 per cent added for waste
No 62 For the viaducts No 7 and 8 and the bridge
1 16 of stone St Maximin at 55 fr (No 46) 63 80
0 11 of mortar at 19 10 fr No 41 2 10
Labour including use of tools and profit 9 50
75 40
No 63 The viaducts No 27 and 28
1 16 of stone St Maximin at 68 fr No 47 78 88
0 11 of mortar at 21 17 fr No 42 2 33
Labour No [illegible] 9 50
90 71
No 64 Between transverse section No 1 and 330
1 16 of stone (Vergelé) Mello at 34 fr (No 48) 39 44
0 11 of mortar at 20 12 No 41 and 42 2 22
Labour No as No 62 9 50
51 16
No 65 - Between transverse sections 1 and 330
1 16 of stone roche La Gache at 11 fr No. 49 1 04
Mortar and labour as No 64 11 72
62 76
No 66 —Between transverse section 1 and 330
1 16 of stone, La Gache at 26 fr No 50 30 16
Mortar and labour as 64 11 72
41 88
No 67 —Between transverse section 330 and 190
1 16 of stone Blancfosse, at 47 fr No 52 54 52
0 11 of mortar, at 20 12 No 43 2 21
Labour, &c. as 62 9 50
66 23
No 68 —Between transverse section 190 and 381
1 16 of stone, Laloise, at 45 fr (No 53) 52 20
Mortar and labour as 67 No 43 11 71
63 91
No 69 —Between transverse section 330 and 190
1 16 of stone (Vergelé) from La Gache, at 37 fr (No 51) 42 92
Mortar and labour as 67 11·71
54 63

Masonry, with the beds and joints worked fair per cubic metre.

No 70 -Between transverse section 1 and 330
Stone, (La Gache,) &c (No 65) 62 76
Additional dressing all the beds and joints 15

		fr. c.	fr. c.
Use of tools	1·50		
	16·50		
Profit 1/10	1·65		
	18·15	18·15	
			80·91

No. 71.—Between transverse section 330 and 490.

	fr. c.	fr. c.
Stone of Gannes, &c., as No. 66	11·88	
Dressing the beds and joints, including use of tools, profit of contractor	50·00	

No. 72.—Transverse sections 480 and 581

	fr. c.	fr. c.
Stone of Faloise, &c., No. 68 ..	66·91	
Additional dressing all the beds and joints, including use of tools, profit, &c.	12·	
		78·91

No. 73.—Between transverse sections 330 and 490.

	fr. c.	fr. c.
Ashler stone, mortar, labour, (Blancfosse) &c. as 67	66·23	
Dressing all the beds and joints, profit, &c. ..	25·00	

RUBBLE MASONRY *per cubic metre.*

The following prices of stone in articles Nos. 74 to 79 it will be seen are calculated from the prices of stone detailed in Nos. 56 to 61 and 1/10 added for waste.

No. 74.—Between transverse sections 1 and 80.

	fr. c.	fr. c.
1·10 of rubble stone (Bethenconstel) at 6· (No. 56)	6·60	
0·333 of mortar, at 19·10 (No. 41) . ..	6·53	
Labour, use of tools, and profit	3·50	
		16·13

No. 75.—Between transverse sections 80 and 330.

	fr. c.	fr. c.
1·10 of rubble (Agnetz) at 7·75 (No. 57) ..		
0·333 of mortar, at 20·14 (No. 41)	6·71	
Labour, &c.	3·50	
		15·74

No. 76.—Between transverse sections 330 and 490

	fr. c.	fr. c.
1·10 of rubble (Blancfosse) at 10·80 (No. 58) ..	11·88	
Mortar, labour, &c.	10·21	
		22·09

No. 77.—Between transverse sections 330 and 490.

	fr. c.	fr. c.
1·10 of rubble (St. Just) at 6·50 (No. 60) ..	7·15	
Mortar, labour, &c., as 75	10·21	
		17·36

No. 78.—Between transverse sections 490 and 581.

	fr. c.	fr. c.
1·10 of rubble (Faloise) at 10 (No. 59) ..	11·	
Mortar, labour, &c. (No. 75)	10·21	
		21·21

No. 79.—Between transverse sections 490 and 581.

	fr. c.	fr. c.
1·10 of rubble stones (Bimont) at 9·08 (No. 61) ..	9·99	
Mortar, labour, &c. as No. 75	10·27	
		20·26

If the rubble masonry be hammer dressed add per cubic metre on Nos. 74 to 79 .. .. .. 1·50

No. 80.—*Dry rubble work,* per *c. m.*

Stone rubble from Bethenconstel quarries, including 1/10 for waste, no labour, see No. 74, between transverse sections, Nos. 1 and 80 — 6·60

Ditto	Agnet	..	80 and 330	8·53
Ditto	Blancfosse	..	330 and 490	11·88
Ditto	St. Just	..	330 and 490	7·15
Ditto	Faloise	..	490 and 581	11·
Ditto	Bimont	..	490 and 581	9·99

To the above price add for labour, tools, profits, &c. .. 1·75

No. 81.—*Labour,* per superficial metre.

Dressing of ashler (hard stone) from the quarries of St. Maximin, on the face and beds, including pointing use of tools and profit .. .. 11·

Ditto, Mello quarries .. ..

Ditto, from the quarry of Blancfosse .. .. ..

Ditto Faloise .. .. ..

No. 82.—Pick-dressing rubble including pointing, use of tools, profit, &c. viz.

For rubble stone from La Gache, Mello	..	..	2·50
Ditto	Blancfosse	.. ..	3·00
Ditto	Faloise	.. .. ..	2·00

No. 83.—Rough hammer dressing of rubble *(de roche)* including pointing, profits, &c. .. .. 1·50

Ditto, for the rubble from the quarries of Blancfosse, St. Just, and Faloise .. .. 1·10

No. 84.—When the rubble is merely dressed and the pointing is not included, 0·25 will be deducted from the last two prices.

STONE PAVING, *per superficial metre,* of the usual paving stones split in two, imbedded in hydraulic mortar.

No. 85.—Ten paving stones of the usual form, including waste, at

	fr. c.	fr. c.
349·39 the thousand (No. 17)	3·49	
0·05 of mortar at 20·12 (No. 43)	1·01	
Splitting the paving stones, dressing them, and forming the basement, &c.	1·35	
		5·85

No. 86.—Bank or mound with covered drains for embanked roads, profits, &c. *per lineal metre* .. .. .. 3·00

No. 87.—*Curb stones* for footways, including dressing, carriage, and mortar, *per lineal metre,* of stone from St. Maximin .. 12·

Ditto	..	..	La Gache	..	10·
Ditto	..	..	Blancfosse	..	9·
Ditto	..	..	Faloise	..	8·

STONE FOR MACADAMISED ROADS.

	fr. c.	fr. c.
No. 88.—One metre of rubble stones, average price ..	8·35	
Carriage, labour, tools, profits, &c.	0·95	
Per superficial metre		9·30

BRICKWORK, *per cubic metre.*

No. 89.—Between transverse sections 330 and 581.

	fr. c.	fr. c.
720 bricks at 41·50 the thousand ..	29·88	
0·25 of mortar at 20·12 (No. 43)	5·03	
Labour, including pointing, use of tools, profits, &c.	11·50	
		46·41

No. 90.—*Pulling down* old structures of stone, clearing the site, carriage to the average distance of 100 metres, and carrying away the rubbish, *per cubic metre* .. .. .. 5·

No. 91.—Ditto where the building is of rubble masonry .. 3·

No. 92.—*Covering* arches, &c. with a layer of "mortar of beton" *per superficial metre.*

	fr. c.	fr. c.
0·05 metre of beton at 16·67 (detail No. 44) ..	0·83	
0·03 of "sand beton" at 12·31 (No. 45) ..	0·37	
Labour, spreading evenly each layer, use of tools, profit included	1·50	
		2·70

ASPHALTE, *per superficial metre.*

No. 93.—For covering arches with a layer 0·01 *m.* in thickness 6·

No. 94.—Ditto for footways, the thickness being 0·015 *m.* including profits, &c. . .. . 5·75

No. 95.—*Fencing* 1·30 *m.* high, *per lineal metre,* consisting of posts, rails, and iron wire, labour included

	fr. c.	fr. c.
consisting of posts, rails, and iron wire, labour included	1·40	
Profit 1/10	0·14	
		1·54

No. 96.—*Caulking, per lineal metre,* the cradle serving as coffer-dam, including profit, &c. .. .. .. 0·60

No. 97.—*Pitching, per superficial metre* .. .. .. 1·50

No. 98.—*Tarpauling,* of bituminous cloth, the thickness of the coating being 0·0065 *m., per superficial metre* .. .. 4·60

No. 99.—*Resinous composition* ("galipot") consisting of one part of grease with 2½ of resin, *per kilogramme* .. .. 0·75

No. 100.—Ditto *per square metre,* including labour and one kilogramme of "galipot" .. .. 0·95

No. 101.—*Painting* in three coats for all colours, on wood and iron, *per superficial metre* .. .. .. 1·20

N.B. The first coat on iron to be in red lead.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

February 28.—The PRESIDENT in the Chair.—*(Continued.)*

"*Account of the Victoria Bridge, erected across the river Wear, on the line of the Durham Junction Railway.*" By David Bremner, Associate Inst. C. E.

The district through which the Durham Junction Railway passes, for the purpose of completing the connexion between the city of Durham, with the towns of Newcastle, South Shields, and Sunderland, is extensively undermined by coal-workings, and great caution was requisite in the selection of a spot which suited the level of the railway, and where a foundation could be formed sufficiently sound to support such a structure as the bridge described in the paper. The advice of Messrs. Walker and Burges was therefore sought by Mr. Harrison, the engineer of the line, and their design was adopted; but subsequently several alterations were made, either to favour the locality or from motives of economy.

The bridge is 810 feet 9 inches long, and 21 feet wide, between the parapets. It is, with the exception of the quoins of the main arches, built of freestone, from the Pensher quarries; there are three semicircular arches, of 144 feet, 100 feet, and 60 feet span respectively, a centre arch of 160 feet

span, with a radius of 72 feet, and three arches of 20 feet span each at either end, forming the abutments. The main pier is founded upon rock, 24 feet beneath the bed of the river; and the height from the foundation to the top of the parapet is 156 feet 6 inches; the under side of the main arch, at the crown, is thus 121 feet 9 inches above the level of the sea.

The paper describes at length the nature of the building materials employed, the dressing of the stones, the composition of the mortar, the general detail and dimensions of the construction, the centering of the arches, with the precautions used in striking them, and gives a very full account of the travelling and other cranes employed in the construction; these are stated to have been very efficient. The north arch, of 100 feet span, containing about 980 tons of stone, was entirely turned with two of the cranes, in 28 hours, giving an average weight of 17½ tons of stone laid by each crane per hour.

The perseverance and practical skill of Messrs. Gibb, of Aberdeen, the contractors, are particularly mentioned, as the difficulties attending the getting down the foundations, especially that of the main pier, were very great, and required all their talent and energy. The detail is given of the precautions taken with, the coffer-dam, in which at one period a steam-engine of 20 H.P., working two pumps of 18 inches diameter each, was insufficient to keep down the water, and it became necessary to drive a range of sheet piling all round withinside the dam, before the leakage through the bad strata above the rock could be stopped.

By calculation it appears, that the pressure on the foundations of the highest pier in the bridge is about 37 tons on each square foot, exclusive of the additional weight of the passing coal-trains, which frequently weigh 120 tons each.

The bridge was commenced on the 17th of March, 1836, and was finished on the 28th of June, 1838, occupying about 711 working days, and cost, with the extra works, nearly £40,000.

The paper is illustrated by three drawings, showing a plan and elevation of the bridge in several stages of its construction, and when completed; the details of the centres, hoists, and cranes, the coffer-dam, engine, pumps, and of the foundations of the whole structure.

Mr. Vignoles had examined the bridge very minutely, and had been much struck with the excellence of the workmanship, which was quite in accordance with the beauty and simplicity of the original design; it was an extraordinary example of care and attention on the part of the contractors, and did infinite credit to all engaged in it; yet with all this, it had cost less, in proportion to its dimensions, than any similar structure in this country.

The President observed, that the structure first proposed was to have been of cast iron, but when he and his partner, Mr. Burges, were consulted, they advised the employment of the freestone from the adjoining quarries, on Lord Londonderry's estate, and they furnished a design, based upon that of Trajan's bridge, at Alcantara, which was adopted by the directors; but subsequently an alteration was made, by introducing three small arches in each abutment, which, in his opinion, had injured the design; that was the extent of his connexion with the bridge; the merit of the construction must be given to the engineer and the contractors, and he must corroborate the statement of the superior manner in which the work had been executed. The bridge had been placed nearly at the spot marked out by Mr. Telford, for the Great North Road to cross the Wear, and as the railway would now form part of the line between Newcastle and Darlington, Mr. Telford's plan would be virtually executed, although with the difference of substituting a railway for a turnpike road.

"Description of the American engine 'Philadelphia,' made by Mr. Norris of Philadelphia, North America, for the Birmingham and Gloucester Railway." By G. D. Bishopp; communicated by Captain W. S. Moorsom, Assoc. Inst. C. E.

The engine described in the paper, was made in the year 1840, and has been in regular work for upwards of two years as an assistant engine upon the Lickey inclined plane, which rises at an angle of 1 in 37½, and is 2 miles 4 chains long. Its construction is what is termed a "bogie" engine, having a four-wheeled truck, to support one end of the boiler, while the other end rests upon the driving wheels. It has outside cylinders, inclined so as to clear the bogie wheels, over which they are placed, and it has inside framing.

The boiler is cylindrical, 9 feet long and 3 feet 4 inches diameter, of plates ⅜-inch thick. The fire-box attached to it has three of its sides square, and the front semicircular, with a spherical dome on the top, and the area of the fire-grate about 10 square feet; it was originally constructed of iron, with water spaces 2½ inches wide, the crown being supported by stay bars in the usual manner; but it was destroyed in about eight months, and has been replaced by a copper fire-box, of plates ⅜-inch thick, with a tube plate ⅞-inch in thickness. The tubes are 94 in number, 8 feet 11 inches long, and 2 inches diameter outside; they were originally of copper, but were replaced by brass tubes when the new fire-box was fixed. Midway between the two end plates, is a third plate through which the tubes pass, so as to serve as a support, and to prevent them from sinking in the middle. The total internal area of the tubes is 404 square feet. The chimney is 13¾ inches diameter internally, by 13 feet 10 inches high from the rails, and has not any damper. The framing is entirely of wrought iron, with the axle guides, &c., forged upon it. The "bogie" frame is also of wrought iron; it is attached to the smoke-box by a centre pin, and is carried by two pair of wheels, 2 feet 6 inches diameter, made of cast iron, chilled, and without tires. The driving wheels are 4 feet diameter, also of cast iron, but with wrought iron tires; they are firmly fixed upon a straight axle, as the cylinders are outside. The cylinders are 12½ inches diameter inside, with a length of stroke of 20 inches.

Minute dimensions are given of the steam passage and valves (the "lead" of which is ¼-inch, and to the eduction pipe nearly ¾-inch, the motion of the slide extending 1 1/12-inch on either side of the centre line); the steam chests, the regulator, the gearing, and feed-pumps, and all the other parts of the engine and connexions.

The general summary of the work done (the details of which are in the archives of the Institution of Civil Engineers) [1] shows that with a maximum load of 8 wagons and 20 men, making a weight of 53¼ tons behind the tender, the engine ascended the Lickey inclined plane at a speed of between 8 and 9 miles per hour. That with 6 wagons, or 39½ tons, the speed was between 10 and 11 miles per hour; that with 5 wagons, or 33 tons, the speed increased to between 12 and 15 miles per hour, and that in assisting the ordinary trains, with 7 passenger carriages, the usual speed has been 13½ miles per hour. There are three engines of this class kept at the Lickey inclined plane for assisting the trains in their ascent, but one is generally found sufficient for the daily service.

The communication is illustrated by seven drawings of the engine and its details of construction, which have been communicated through Captain W. S. Moorsom, Assoc Inst. C. E.

Captain Moorsom, in answer to questions from members, explained that—

	Miles.	Chains.
The length of the Lickey incline, rising 1 in 37 4/10, was	2	
The bank engine ran out from its house at the foot of the incline, at each trip, for a length of		14
And continued running at the head of the train after surmounting the incline, for about		23
Thus giving an actual length on the ascent of . . .	2	41

And as the same distance was covered in returning, the length of each trip, was rather more than 5 miles. This was exclusive of some occasional piloting and train trips, which were, however, included in the general statement of expenses.

The account of the entire expense of the bank engine establishment was made up of—1, The wages of the drivers and firemen; 2, Cost of coke, oil and tallow; 3, Repairs, including wages and materials; 4, Depreciation of stock, stated at the end of each half-year; 5, General charges, comprising wages of pumpers, cokemen, cleaners and labourers; cost of fire-wood, hose-pipes, cotton waste, and all other stores; salaries of superintendents, clerks, foremen, time-keepers, and store-keepers; and the premium paid to the men for saving the coke.

The cost of working the incline plane was therefore, for each half-year ending—

	31st December, 1841.			30th June, 1842.			31st December, 1842.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.
Wages . .	132	7	11	95	9	10	117	14	8
Coke . . .	324	13	6[2]	191	11	4[3]	165	19	0[4]
Oil and Tallow	19	8	4	27	1	7	17	18	6
Repairs . .	215	1	0	260	3	8	92	6	11
General Charges	237	19	7	93	15	7	76	6	11
	989	10	1	668	2	0	470	6	0
Depreciation of Stock	99	0	0	Nil, having been impvd.			89	16	0
Total . .	1088	10	1	668	2	0	560	2	0
Trips run	1212			1276			1320		
Miles run . . .	6210			6380			6600		
Cost per mile run—	s.	d.		s.	d.		s.	d.	
1st. Exclusive of depreciation .	3	2¼		2	1		1	5	
2nd. Including depreciation . .	3	6		0	0		1	8¼	

The engines have been improved by the alterations made since their arrival in England. These changes chiefly consisted in suppressing the tender, and placing the receptacle for water and coke upon the boiler of the engine, and in using the waste steam to heat the water; these had increased the efficiency of the machine, and caused a considerable economy of fuel. All the other changes were of minor importance, and had been chiefly suggested

[1] "Account of a Series of Experiments on Locomotive Engines, &c.," by Capt. Moorsom, with Supplement, read April 7, 1840. Minutes of Proceedings, page 45.
[2] 27s. per ton. [3] 26s. 4d. per ton. [4] 25s. 11½d. per ton.

by the exigencies of the peculiar locality where the engine worked. The economical working of the engine was due partly to the attention and skill of the driver, who had become better acquainted with the capabilities of the machine, had a better knowledge of the locality, and was stimulated by a premium upon the saving of coke and other stores consumed, but was principally to be attributed to the judicious alterations that had been made in the construction. There had not been any reduction of the men's wages. The usual pressure of steam was between 60 lb. and 66 lb. per square inch. The weights of the trains varied considerably; they rarely consisted of less than three carriages; the heaviest he remembered weighed 98 tons, exclusive of the weight of the two engines, which were employed to convey it up the incline. He had not made any accurate experiments, as to the amount of slipping of the wheels upon the rails, but with the ordinary traffic he did not believe that any practical loss was occasioned by it.

Mr. M'Connell stated that the pressure of steam in the boiler of the American engine, when the experiments were tried, was more than 70 lb. per square inch; the spring balance was screwed down to 65 lb. pressure, and as owing to the reduced speed of the engine, the steam was generated faster than it could be consumed by the cylinders, and thrown off by the safety valves, the pressure continued increasing. It should be understood that Bury's engine, alluded to in the experiments, was intended rather for conveying trains at higher velocities, than for mounting the incline with a heavy load, it was therefore labouring under a disadvantage. The steam ports in the American engine were very large, and although steam was thereby wasted, that arrangement was of material assistance, in the peculiar duty for which the machine was intended.

Mr. Braithwaite observed, that the quantity of coke consumed appeared to exceed materially that upon other railways; he understood that an engine recently constructed by Messrs. Rennie used about 18 lb. per mile, and that on the Liverpool and Manchester line, the average consumption was 16 lb. per mile. It appeared to him that the real questions were, the absolute duty performed with a given quantity of fuel, and at what cost and also whether the greater adhesion of the driving wheels was due to the weight imposed upon the engine, by fixing the water tank upon the boiler, and the coke boxes upon the foot-plate, after suppressing the tender.

Mr. M'Connell replied that the peculiar duty of these bank engines required the steam to be kept up for about 16 hours daily, during which period they made eight trips, amounting in the whole to about 40 miles, of which, during 20 miles only actual duty was performed, so that the greater portion of the coke was consumed while the engines were at rest. When they were running with luggage trains on the line the quantity of coke consumed was very small. The difference of cost, in consequence of the various alterations, and the improved mode of working the engine, was very great. In January 1842, the cost per trip on the incline was 17s. 5d., but in January 1843, it only amounted to 7s. 1d.

The average weight of the luggage trains was about 60 tons; two assistant engines were used for heavy trains, merely as a precaution, in case of the wheels slipping; otherwise one of the "Bogie" engines could perform the duty alone, as with the passenger trains, which were always conveyed up by the bank engine alone.

Captain Moorsom said that the main question arising from this investigation, was by what system steep gradients could be worked with the greatest efficiency, security, and economy, he would, however, in the present case suppose the two former positions to be equal in both cases, and would inquire only into the economy.

It appeared from the returns of the London and Birmingham Railway Company, that the annual cost of working the Euston Square incline plane, which was 1¼ mile long, with an average angle of 1 in 7 with stationary power and an endless rope, was -

In 1840 ..	£2150
1841 .	1376
1842	1215

On the Edinburgh and Glasgow Railway, the expenditure upon the Glasgow incline, which was about one mile in length, at an inclination of 1 in 42, also with stationary power, was £1516 in 1842. He had understood (but he could not produce authority for his statement) that, on the Great Western Railway, the cost of working the Box tunnel incline alone, was, in 1841, about £3500; and in 1842 it had been reduced to nearly £2500; that was worked by locomotive power. Taking into consideration the number and weight of the trains, their speed, and the relative length and the angle of the inclines, he believed that the Euston Square incline might be said to perform about half as much work as that on the Lickey.

Mr. M'Connell presented drawings of the locomotive after being altered, of the detaching catch, and of the improved brake. After detailing some important alterations made by him in the valves, as well as the substitution of a different description of fire-bars and fire-frame, under an arrangement by which a considerable saving had been effected in the consumption of fuel, he stated that, for several reasons, but chiefly to increase the adhesion of the driving wheels of the engine, the tender had been suppressed, and a large tank constructed to be carried on the boiler of the engine. It was made of the best plate iron, ¼-inch thick; its length was 8 feet 9 inches, breadth 3 feet 5 inches, depth 3 feet at the sides, and 1 foot 11 inches at the centre; the bottom was made to fit the form of the boiler, and was bedded upon a coating of thick felt; it was held in its place by four wrought-iron straps passing round the boiler. Advantage had been taken of the waste steam, by introducing a copper pipe from the top of the fire-box dome, into the upper part of the tank, carrying it, to and fro, from one end to the other, with an open extremity to allow the escape of the steam into the water; this pipe was furnished with a stop-cock; in addition to this a number of pipes were introduced from the smoke-box into the tank, by which arrangement, the water in the tank was maintained at the boiling temperature, previous to being pumped into the boiler, which, in addition to the saving of fuel, proved advantageous in diminishing the leakage and breakage of the tubes and stays, arising from the sudden contraction by pumping in cold water, when the steam was shut off while descending the incline. The tank contained upwards of 400 gallons of water, a quantity sufficient for the engine over 18 miles, and goods' trains had been taken the whole length of the line (53 miles) by these engines with safety and economy. The supply of coke was carried in sheet-iron boxes, each containing about 40 lb. weight, and of a size to fit the fire-door of the boiler, ranged on platforms on each side of the foot-plate, which platforms were fitted with boxes, to hold the necessary tools required for the engines.

Mr. M'Connell then described a powerful and efficient description of brake, which he had constructed to act upon the driving wheels, it was so arranged that the whole weight of the fire-box end of the engine could be thrown on the wheel tires; one brake had been found quite sufficient to stop the engine on any part of the incline; from their position they were very easily brought into action; the end working upon the fore part of the wheel, was connected to a stud made fast to the framing of the engine; the other end was worked by a screw 1¾ of an inch in diameter, passing through a bracket fixed on the boiler, which served as a nut. The main spring-plate of the brake was rendered flexible by the wood blocks being in short segments, thus enabling their entire surface to be brought into close contact with the periphery of the wheel.

A new form of catch, employed for detaching the engine from the train, was described, it was stated to be managed with facility, and at the same time was perfectly secure. The principal advantages of these engines were, he believed, the economy in the consumption of fuel, and the increased adhesion of the driving wheels (the weight upon them being upwards of 10 tons, thus rendering the engine more effective in drawing heavy loads). The expenses of repairs had also been much decreased by the improvements suggested by practice.

The following statement showed the comparative consumption of coke at different periods, viz.: -

For six months ending June	1841,	92·11 lb. of coke per mile run.
,, January	1842,	86·
,, June	1842,	53·35
,, January	1843,	43·2

March 7.—The President in the Chair.

His Royal Highness Prince Albert was elected by acclamation an honorary member.

"*On the causes of the unexpected breakage of the Journals of Railway Axles; and on the means of preventing such accidents by observing the law of continuity in their construction.*" By William John Macquorn Rankine, Assoc. Inst. C. E.

The paper commences by stating that the unexpected fracture of originally good axles, after running for several years, without any appearance of unsoundness, must be caused by a gradual deterioration in the course of working; that with respect to the nature and cause of this deterioration, nothing but hypotheses have hitherto been given; the most accepted reason being, that the fibrous texture of malleable iron assumes gradually a crystallized structure, which being weaker in a longitudinal direction, gives way under a shock that the same iron when in its fibrous state would have sustained without injury.

The author contends that it is difficult to prove that an axle which, when broken, shall be found of a crystallized texture, may not have been so originally at the point of fracture, although at other parts the texture may have been fibrous.

He then proceeds to show that a gradual deterioration takes place in axles without their losing the fibrous texture, and that it does not arise from the cause to which it is usually attributed. From among a large collection of faggoted axles which had broken after running between two and four years, five specimens were selected, of which drawings are given, representing the exact appearance of the metal at the point of fracture, which in each case occurred at the re-entering angle, where the journal joined the body. The fractures appear to have commenced with a smooth, regularly-formed, minute fissure, extending all round the neck of the journal, and penetrating on an average to a depth of half an inch. They would appear to have gradually penetrated from the surface towards the centre, in such a manner that the broken end of the journal was convex, and necessarily the body of the axle was concave, until the thickness of sound iron in the centre became insufficient to support the shocks to which it was exposed. In all the specimens the iron remained fibrous; proving that no material change had taken place in its structure.

The author then proceeds to argue, that the breaking of these axles was owing to a tendency of the abrupt change in thickness where the journal met the shoulder, to increase the effect of shocks at that point; that owing

to the method of manufacture the fibres did not follow the surface of the shoulder, but that they penetrated straight into the body of the axle; that the power of a fibre to resist a shock being in the compound ratio of its strength and extensibility, that portion of it which is within the mass of the body of the axle will have less elasticity than that in the journal, and it is probable that the fibres give way at the shoulder on account of their elastic play being suddenly arrested at that point. This he contends would account for the direction of the fissure being inward towards the body of the axle, so that the surface of the fracture was always convex in that direction. It is therefore proposed, in manufacturing axles, to form the journals with a large curve in the shoulder, before going to the lathe, so that the fibre shall be continuous throughout; the increased action at the shoulder would thus be made efficient in adding strength to the fibres without impeding their elasticity. Several axles having one end manufactured in this manner, and the other by the ordinary method, were broken: the former resisted from five to eight blows of a hammer, while the latter were invariably broken by one blow. The vibratory action to which axles are subjected is then considered, and it is contended, that at the place where there is an abrupt change in the extent of the oscillations of the molecules of the iron, these molecules must necessarily be more easily torn asunder; and that in the improved form of journals, as the power of resisting shocks is increased by the continuity of the superficial fibres, so is the destructive action of the vibratory movement prevented by the continuity of form.

The paper is illustrated by five drawings, showing the section of the journals of broken axles, and their appearance at the moment of fracture.

Remarks.—Mr. York agreed with Mr. Rankine in several point . and stated, that since the last meeting he had made a series of experiments, which confirmed his opinion relative to the vibration in solid railway axles being arrested when the wheels were keyed on tight. In all such cases, where the vibration was checked, fracture would, he contended, be more likely to ensue, but with hollow axles there was very little difference of sound when struck, and no diminution of strength after keying on the wheels; this he attributed to the regular distribution of the molecules in the metal of the hollow cylinder.

Mr. Parkes coincided with Mr. York's opinion, and he believed that hollow axles would eventually supersede solid ones, particularly if they had sufficient rigidity for resisting flexure. Their faculty of transmitting vibration more readily was in their favour; it was well understood that in pieces of ordnance and musket barrels great regularity of proportion in the metal was requisite, in order to insure the equal transmission of the vibration, caused by the sudden expansion of the metal at the moment of the explosion, and unless the vibration was regular the barrel would burst or the ball would not be correctly delivered.

Mr. Greener, of Newcastle, among other experiments,* turned the outside of a musket barrel to a correct taper, and fixed tight upon it at given intervals several rings of lead 2 inches in thickness; on firing a charge of 4 drachms of powder he found that all the rings were loosened and had all expanded regularly in their diameter. It was a well-known fact that cannon seldom or never burst from continuous firing; such accidents, unless they arose from peculiar circumstances, generally occurred in consequence either of inequality in the nature of the metal or irregularity in its distribution; to the latter cause must be attributed the bursting of the "Mortier monstre," before Antwerp, and of a large gun which was proved at Deal some time since; this latter gun burst at the third discharge, after delivering the ball better than on either of the previous discharges; it was evident that the fracture did not occur under the explosion of the powder, but on the reentering of the air into the mouth of the gun after the discharge, and also because the thickness of metal was not well-proportioned, whereby the vibration was unduly checked, the cohesion of the molecules of the metal was destroyed, and the gun fell into several pieces, without any of them being projected, as they would have been by the usual effect of an explosive force.

The most practical millwrights were well aware of the superiority of hollow shafts, and they were frequently used, as they were more easily kept cool than solid ones, especially at high velocities, when shafts were peculiarly liable to injury from percussive force or from a series of recurring vibrations.

March 14.—The PRESIDENT in the Chair.

"Description of a method of laying down Railway Curves on the ground." By William John Macquorn Rankine, Assoc. Inst. C.E.

The method described in the paper depends on the well-known principle, that the angle subtended at any point of the circumference of a circle, by a given arc of that circle, is equal to half of the angle subtended at the centre by the same arc. The points which must be ascertained beforehand are the same as in every other method of laying down curves, namely,—the radius; the number of degrees, minutes, and seconds in the entire arc of the curve: and the length of the two equal tangents; either of which three quantities can be calculated from the other two. The commencement of the curve A, its termination B, and the intersection of the two tangents D, are to be marked on the ground as usual. It is supposed that the centre line of the railway is marked by stakes driven at equal distances—say of 100 feet. Let E represent the last stake in the portion of the line immediately preceding the curve, the distance A F from the commencement of the curve to the first stake in it will be the difference between 100 feet and E A. The angle at the circumference subtended by the arc A F must be calculated, and a delicate theodolite having been planted at A, this angle is to be laid off from the tangent. The telescope will then point in the proper direction for the first stake in the curve, and its proper distance from A being set off by means of the chain, its position will be determined at once. The angles at the circumference subtended by A F + 100 ft., A F + 200 ft., A F + 300 ft., A F + 400 ft., &c., being also calculated, and laid off in succession, will respectively give the proper direction for the ensuing stakes G, H, I, &c., which are at the same time to be placed successively at uniform distances of 100 ft. by means of the chain. It is scarcely necessary to observe, that the difference between an arc of 100 ft. and its chord, on any curve which usually occurs on railways, is too small to cause any perceptible error in practice, even in a very long distance; but should curves occur of unusually short radii, it is easy to calculate the proper chord, and set it off from each stake to the next, instead of 100 ft., the length of the arc. When the inequalities of the ground prevent a distant view from any three stations to lay down the entire curve from them, any stake which has already been placed in a commanding position will answer as a station for the theodolite. By this method the operation of laying down a circular curve of any radius is made exactly analogous to that of laying down a straight line with the assistance of the telescopic sights of a theodolite. It is stated that by this method the curve is laid down with accuracy at the first operation; that any accidental error in the position of a single stake, affects that stake only; and it has been found in practice that the progressively increasing errors of the old method are entirely avoided.

Remarks.—Mr. Gravatt observed that a well-made theodolite was a convenient instrument for setting out curves for railways, and that it had been used by him and his assistants for this purpose for several years. The common theodolite was not, however, in practice universally applicable without some further contrivances for accommodating it to this peculiar service. He stated that the circular arc (used, he believed, almost universally on railways) was not the true curve for a line of rails, as might be proved by considering that a straight line of road required both rails to be at the same level, when viewed in the cross section, whilst on a curved road the outside rail required to be raised, in order to resist the tendency of the engine and carriages to fly off the rails in going round the curve. Where a straight line was joined on to a circular arc, the before-mentioned condition would require an instantaneous and vertical rise of one of the rails, which was a condition that could not be fulfilled. In curves of contrary flexure, if composed of circular arcs, the difficulty was increased; for the outer rail, which ought to be the highest, suddenly became the inner and the lowest, so that an instantaneous elevation of one rail, and a corresponding depression of the other was required; if the curves were of the same radius, the alteration would be of double the extent to that required when passing on to the same arc from a straight line. Therefore as the outside rail must be in all cases the highest, the circular arc, which required the manifestly false condition of an instantaneous elevation, could not be the true curve. He had several years since demonstrated that the true curve was one, which commenced with an infinite radius, decreased in a regular manner, in advancing on the curve, when the radius might be constant for some time, and then increased again to infinity, before it joined either a straight line or another curve of contrary flexure. He had fixed upon the elastic curve, which complied with all the conditions required, but other curves were also applicable. His late assistant, Mr. W. Froude, had found that arcs of a cubic parabola, whilst they complied with the necessary conditions, were extremely convenient in practice; the equation and its fluxions, or differential co-efficients, being very simple and easy of application. Mr. Froude had also applied other properties of that curve, so that, with the assistance of a few calculated tables, the process of setting out a true curve was rendered as easy in practice as setting out a circular arc. With any curve there was considerable practical difficulty in finding the direction of the tangents, the radii of curvature, and the position of the curves upon the ground. Mr. Gravatt used what he termed a skeleton plan, of several stakes driven into the ground nearly in the course of the intended line, expressing their position by columns of figures with reference to two co-ordinates; thus obtaining a numerical accuracy far greater than that of any drawn plan. By using a table of sines and co-sines, a few hours' calculation would save many days' labour in the field, besides ensuring an accuracy not otherwise to be obtained.

ON HORSE POWER.

"Results of the application of Horse Power to raising Water from the working shafts at Saltwood Tunnel, on the South-Eastern Railway, in 1842." By Frederick William Simms, M. Inst. C. E.

This tunnel is driven in the middle bed of the lower green sand, between which and the surface of the ground is interposed only the upper bed of the same stratum; but in sinking the eleven shafts for the work, it was found that at the level of the top of the tunnel the ground assumed the character of a quick sand, saturated with water, in such quantity that it could not be reduced by manual labour. Under these circumstances horse gins were erected for drawing the water by barrels, containing 100 gallons each, weighing when full about 1310 lbs.

The engineer's intention was to drive simultaneously from these shafts, in

* Greener 'On the Gun,' p. 157; and "On the Science of Gunnery," p. 242.

the direction of the tunnel, an adit or heading, to carry off the water; but the earth, which was sand mixed with fine particles of blue clay, was so filled with water as to become a mass of semi-fluid mud, great exertions were therefore necessary to overcome the water, without erecting pumps. At first this was accomplished by making each horse work for 12 hours, and then for 8 hours per day, allowing one hour for food and rest; as the water increased it became necessary to work night and day, and the time of each horse's working was reduced generally to 6 hours, and sometimes to 3 hours. As all the horses were hired at the rate of 7s. per day, the author, who had the direction of the works, ordered a daily register to be kept of the actual work done by each horse, for the double purpose of ascertaining whether they all performed their duty, and also hoping to collect a body of facts relative to horse power which might be useful hereafter. This detailed register, which was kept by Mr. P. N. Brockedon, is appended to the communication.

The author gives as a proposition, "That the proper estimate of horse power, would be that which measures the weight that a horse would draw up out of a well; the animal acting by a horizontal line of traction turned into the vertical direction by a simple pulley, whose *friction* should be reduced as much as possible." He states that the manner in which the work was performed necessarily approached very nearly to these conditions; and after giving the principal dimensions of the horse gins, he analyzes each set of experiments, and by taking the mean of those against which no objections could be urged, he arrives at the following results —

The Power of a Horse working for 8 hours = 23 112 lb. raised 1 ft. high in one minute.

Ditto		21,500	ditto.
Ditto	4½	27,056	ditto.
Ditto	3	32,213	ditto.

Of these results he thinks the experiment for 6 hou. and 4 hours alone should be adopted as practical guides, all the others being in some degree objectionable.

As a means of comparison, the following table of estimates of horse power is given :—

Name.	Pounds raised 1 foot high in a minute.	Hours of Work.	Authority.
Boulton and Watt ..	33,000	8	Robison's Mech. Phil. vol. ii. p. 145.
Tredgold	27,500	8	Tredgold on Railroads, p. 69.
Desaguliers	14,000	8	
Ditto	27,500	Not stated.	Dr. Gregory's Mathematics for Practical Men, p. 183.
Sauveur	34,020	8	
Moore, for Society of Arts	21,120	Not stated.	
Smeaton	22,000	Not stated.	

These are much higher results than the average of his experiments, and would more nearly accord with the extremes obtained by him; but under such excessive fatigue the horses were speedily exhausted, and died rapidly. Nearly one hundred horses were employed,[6] they were of good quality, their average height was 15 hands ¾ inch, and their weight about 10½ cwt., and they cost from 20*l.* to 40*l.* each. They had as much corn as they could eat, and were well attended to.

The total quantity of work done by the horses, and its cost, was as under :

Registered quantity of water drawn 101 feet, the average height, 28,220,800 gallons	=128,505 tons.
Ditto, earth 3,500 yards, 1 ton 6 cwt. per yard..	= 4,550
Total weight drawn to the surface	133,055
Total cost of horse labour, including a boy to drive each horse	1,585 15 3

Or, 2·85 pence per ton, the average height of 101 feet

As soon as the adit was driven, all the water was carried off by it, and the works are stated to be perfectly dry.

Remarks.—Mr. Palmer said, it should be understood, that in stating 33,000 lb raised one foot high in a minute, as the measure of the power of a horse Boulton and Watt had not intended to fix that as the average work which horses were capable of performing: they had taken the highest results of duty performed by powerful horses, in order to convince the purchasers of their steam-engines that they received all that had been contracted for. He had made some experiments on the amount of work performed by horses tracking boats on canals: on the upper end of the mast of the boat a pulley was hung; over this the towing rope was passed, with the means of suspending to its extremity given weights, so as exactly to balance the power exerted by the horse. The results arrived at by these means were so various, that he could not deduce any average conclusions; as the power exerted varied between 30 lb. and 120 lb., the power diminishing as the speed was increased: he thought that 2½ miles was too high an average estimate, and that it should not exceed 2 miles per hour.

Mr. Field remarked that in all estimates of horse power, the speed was considered to be at an average of 2½ miles per hour, and all experiments were reduced to that standard.

Mr. Hawkins said, that some years since, he had made numerous inquiries respecting the work done by horses in drawing upon common turnpike roads, and found, that four good horses could draw an ordinary stage coach, with its complement of passengers, 8 miles a-day at the rate of 10 miles an hour; that if they ran stages of 10 miles in the hour, the horses must rest one day in each week: that good horses, so worked, would last only five years, each horse drawing about half a ton; he had been informed by wagoners, that good horses would walk, at the rate of 2½ miles per hour, for twelve hours out of the twenty-four, making 30 miles a-day, and that they would continue to do such work, day by day, each horse drawing one ton, for many years, provided they had been worked hard when young.

Mr. Gravatt observed, that although there might exist some hesitation in receiving these results of work actually performed, as a general measure of horse's power, yet as engineers frequently required to know what could be performed by horses, when employed for short periods, in works of haste or difficulty, he thought that the experiments were useful, and would form good data for reference. He was sorry to observe that in too many cases, an idea was prevalent, that it was cheaper to work a small stock of horses to death, than to keep a large number and to work them fairly; the results which he had been enabled to arrive at, were perhaps not a fair value of a horse's work, continued for any length of time, at the best rate of economy, for both the contractor and the employer.

The President believed that however, in cases of emergency, which he allowed did occur in engineering works, the forced system of labour mentioned by Mr. Gravatt might be tolerated, he was convinced that it was not the most economical, but on the contrary, humanity and economy would be found to go hand in hand. It would be desirable to know the average speed at which the different rates of work had been performed; this was essential in order to found any calculation upon the results given. Coach proprietors calculated that, at a speed of 10 miles per hour, a horse was required for every mile going and returning, so that one horse was kept for every mile of road. Now supposing a four-horse coach, with an average load, to weigh 2 tons, the load for each horse was 10 cwt.; whereas in the case of a horse drawing a cart, the gross load frequently amounted to 2 tons, but the speed was reduced to 2½ miles per hour, at which pace he conceived that 16 miles per day might be considered a fair day's work; this therefore was double the distance with four times the load, or eight times the coach-work, but with a heavier horse. The law that the quantity of work done, was as the square root of the velocity, or, as the cube root of the velocity, in equal times, was confined to work upon canals, or bodies moving through water.

Mr. Rennie had tried some experiments on the force of traction of the boats on the Grand Junction Canal. The towing rope was attached to a dynamometer which had previously been tested by weights. The horse, although urged at first starting, was afterwards allowed to fall into his natural speed, which was 2½ miles per hour on the average of 20 miles. The maximum speed was 4 miles, and the minimum 2 miles per hour. The dynamometer indicated an average of 180 lb., which was capable of overcoming the resistance of the loaded barge of 25 tons, being in the ratio of 1·500. The weight of the horse was about 11 cwt. He had also tried many experiments upon a fast boat lent to him in 1833 by the late Colonel Page. These experiments were principally made in order to ascertain the comparative resistance of vessels moving through water at different velocities, and the Grand Junction Canal afforded a convenient opportunity of undertaking them. The boat was 70 feet in length, 4 feet in breadth, and drew 9 inches of water. The traction indicated by the dynamometer the following resistance

Miles per hour.		lb.	Miles per hour.		lb.
At 2½	the resistance was	20	At 6	the resistance was	97 to 214
3		27	7	„	250
3½		30	8	„	336
4		50	9·69	„	411
4½		60	10	„	375
		70 to 75	11¼	„	392
			Average	. . . .	336

One horse was employed in these experiments. Two horses were employed in these experiments.

Stakes were fixed near the margin of the canal, so as to ascertain the rise and fall of the wave caused by the boat in passing; and it was observed that when the boat passed with a velocity of from 4 to 6 miles per hour, the rise of the wave was 5 inches, and the fall 5 inches, making a wave of 10 inches in depth; and when the velocity was 11¼ miles, the rise was reduced to 2½ inches, and the fall to 2½ inches. Great difference existed in the power of

[6] The horses were supplied by Mr. Richard Lewis, Folkestone, Kent.

horses, their weights, and structure; and the large dray horses used by Messrs. Barclay, Perkins, and Co. did a full average duty as assumed by Boulton and Watt; but considering the average power of strong and of weak animals, he had adopted 22,000 lb. raised 1 foot high as the standard; much however depended on the nature of the work performed.

Mr. Charles Wood remarked that although, on an emergency, it might be necessary to work horses to the extent which had been mentioned, it had always been found more economical to feed them well, and not unduly to force the speed, the weight drawn, or the hours of labour. By the recorded experiments on ploughing, which were tried at Lord Ducie's and by Mr. Pusey, it was shown that any increase of speed diminished the amount of work done, in a greater ratio than it was affected by an increase of the load. In drawing loads the weight of the animal was a point of considerable importance; and when extra exertion and muscular action were required, the nearer horses approached to "thorough bred," the greater was the result.

Mr. Davidson gave the following statement of the work performed by a London brewer's horse per day; the cost of feed and of wear and tear per horse per annum, being derived from actual experience among a large number of horses at Messrs. Truman, Hanbury, and Co.'s brewery. The feed, &c., is supposed to have cost the same per quarter, per truss, &c. each year.

Years.	Lb. weight drawn 6½ mls. per horse per day.	Lb. weight drawn 6½ mls. per horse returning per day.	Average lb. weight drawn 13 miles per horse per day.	Cost of feed and straw per horse per annum.			Difference per horse, ditto bought and sold per annum.		
	lb.	lb.	lb.	£.	s.	d.	£.	s.	d.
1835	5148	1716	3432	43	2	7	10	0	3
1336	5072	1707	3389	43	16	6	9	18	0
1837[7]	..	..	..		..			..	
1838	5057	1698	3377	41	18	0	9	15	9
1839	5287	1740	3513	42	9	11	9	7	1
1840[8]	5786	1820	3803	46	11	7	7	17	11
1841	5311	1750	3530	45	0	1	10	16	11
1842	5263	1740	3501	47	0	9	10	8	0
Total	36,924	12,171	24,545	309	19	5	68	3	11
Average for seven years nearly.	5275	1738	3506	44	5	7	9	14	10

Mr. Horne stated that Messrs. Tredwell had a contract on the South-Eastern Railway, near where Mr. Simms' experiments were made; they had upwards of 100 horses, whose average cost was about 30*l.*; they were worked 10 hours per day, and were well fed, so that their value was but little reduced, and they were eventually sold for nearly the same prices as they originally cost. These contractors had about 400 horses on the Southampton Railway, which cost them about 25*l.* each. The same course of not over-working, and feeding them well, was pursued from motives of economy; and they found it answer. It was Mr. Jackson's practice to keep so many horses for his work as not to be under the necessity of working them more than 10 hours per day: he gave to each a peck of corn a-day; by this means he has been able to keep up their value. On the Chester and Crewe Railway he had about 300 horses at work, and towards the end of the contract, owing to circumstances over which he had no control, he was obliged to work them 14 or 15 hours per day; and in the course of four months horses that had been worth 25*l.* were so reduced as not to be valued at above 7*l.* He is a great advocate for steady work and good keep. On the Tame Valley Canal there had been sometimes between 300 and 400 horses, but as the work was nearly finished many had been sold. Those sub-contractors who had kept a sufficient number of horses for the work, so as not to have them in harness more than 12 hours per day, had realized nearly the same prices they had given for them in the first instance. The horses belonging to Mr. Edwards, the sub-contractor for the excavation of Newton Hill, and those of Mr. W. Tredwell, sub-contractor for the Friar Park Farm cuttings, were purchased from the same parties at prices varying from 20*l.* to 35*l.* The former had been acting on the principle of getting out of the horses all he could, working them frequently 15 and 16 hours at a time; and the consequence was, that all his stock was in bad condition, and he would be glad to get 6*l.* or 7*l.* a-piece for them. On the other hand, Mr. W. Tredwell, who was an excellent horse-master, and who did not work his horses beyond their strength, would be able to sell them for about as much as he gave for them—indeed he had done so already for those that he had parted with. Having been a good many years in the service of the late Mr. McIntosh, Mr. Horne could state that it never was his system to over-work his horses. It did sometimes happen that there was no alternative, but the deviation from the regular rule in every instance showed that his system was founded on right principles. The over-worked horses were most liable to disease, and the time lost by illness formed an important item; whereas there were plenty of instances in which horses that had worked their regular 10 hours per day, and had been properly fed, had worked for five or six years without losing a single day by illness. On the whole, he felt convinced that, both on the score of humanity and economy, the horse was the more valuable servant when treated with kindness.

Mr. Beardmore said that a case had occurred in a work near Plymouth which he believed would give the fair value of the work actually performed daily by a horse for a considerable period. A quarry wagon, weighing 2¼ tons, carrying an average load of stone of 5¾ tons, was drawn by one horse along a railway 960 feet in length, 260 feet of it being level and the remaining 700 feet having an inclination of 1 in 138; during 48 working days the number of trips was 1,302, or an average of 27·1 trips each day; the time of performing each trip was 4 minutes, or at a speed of 2·72 miles per hour; and the total weight drawn, including that of the wagons, was 23,959,600 lb. Repeated experiments proved, that upon the incline of 1 in 138, the wagons in their ordinary working state would just remain stationary, the friction was therefore assumed to be 16·2 lb. per ton; by calculation it was found that the horse raised 39,320 lb. 1 foot high per minute during the eight working hours each day, the useful effect, or net amount of stone carried, being 21,738 lb. raised 1 foot per minute. This difference between the work done and the useful effect, arose from the necessary strength and weight of the wagons. The animal employed was a common Devonshire cart-horse, eight years old, 15 hands high, and weighed 10¾ cwt.; he continued doing the same work throughout a whole summer, remaining in good condition; but a lighter horse was found unequal to it.

"*Description of Lieutenant D. Rankine's Spring Contractor.*" By Wm. John Macquorn Rankine, Assoc. Inst. C. E.

This paper describes a contrivance for suiting the action of the springs of railway carriages to variable loads, so as to give the proper ease of motion to a carriage when heavily laden, and at the same time to be sufficiently flexible for light loads. Its effect is to make the strength and stiffness of the spring increase in proportion to the load placed upon it. Each extremity of the spring, instead of supporting a shackle or roller, as in the usual construction, carries a small convex plate of cast iron. The form and position of this plate are so adjusted, that when the carriage is unloaded, it bears on the extreme end of the spring, thus allowing it to exert the greatest amount of flexibility; but as the plate is convex, the more the load increases, and the further the ends of the spring descend, the nearer does the point of bearing of the plate upon the spring approach to the centre or fulcrum, so that the convex plate or contractor tends to diminish the virtual length of the spring in proportion to the load, the result of which is to increase the strength of the spring, in the inverse ratio of its virtual length, and its stiffness in the inverse ratio of the cube of the same quantity. The author then gives, in a tabular form, the details and the results of some experiments made on springs of this description, which are similar to those now in use on the Edinburgh and Dalkeith Railway. The springs were 4 feet long, each consisting of ten plates, each ⅜ inch thick, and 2¼ inches broad. The contractors were cast with a radius of 12¼ inches, and so constructed as not to act until the load on each spring exceeded 10 cwt., and with a load of 30 cwt. they should have contracted the distance between the bearing points to 3 feet 4 inches instead of 4 feet; by this means the strength of the spring was increased in the ratio of 6 to 5, and its stiffness in the ratio of 216 to 125.* The advantages stated to be derived from the use of these springs on the Edinburgh and Dalkeith Railway, and other lines, are, that they afford the same ease of motion to a single passenger as to 40 or 50 in one carriage; they save wear both of carriages and railway track; they produce the strength and stiffness requisite for the maximum load with less weight of metal; they are not more expensive than rollers; and they are not offensive in appearance, indeed they would not be observed unless they were pointed out.

THE PRESIDENT'S CONVERSAZIONE.

Mr. Walker, the President of the Institute of Civil Engineers, gave his annual conversazioné, at his residence in Great George Street, Westminster, on Friday 16th, and Saturday 17th ult., extending it to two evenings instead of one, as hitherto, in consequence of the crowded state of the rooms last year, and with his usual liberality to afford his numerous guests ample opportunity to examine the works of art and science distributed throughout

[7] In 1837 a disease was prevalent among the horses; therefore that year is omitted.

[8] Fewer horses were bought during the year 1840; the old horses were better fed, and harder worked.

* Since this communication was made, contractors of greater length and increased radius of curvature have been applied, so as to produce a contraction of 6 inches at each end of the spring when fully loaded, which increases the strength in the ratio of 4 : 3, and the stiffness in that of 64 : 27. The details of the construction of these contractors, with a drawing of them, as applied to the springs of the carriages on the Edinburgh and Dalkeith Railway, are given in the addendum to the original paper.

his spacious suite of rooms. On the former evening about 300 persons attended, and on the latter a brilliant company assembled, comprising the most distinguished persons for rank in science or the fine arts, who all appeared to feel the hospitality and attention of the worthy host, who attended by Mr. Manby, the Secretary of the Institution, received the visitors on arriving, and directed their attention to the numerous models and works of art. The upper room was lighted by gas chandeliers, the burners of which were enclosed in glass globes, on Professor Faraday's ventilating principle, (ante p. 106.)

Soon after 9 o'clock on Saturday Evening, H. R. H. Prince Albert arrived, attended by Sir E. Bowater. The President escorted his distinguished guest through the principal rooms, explaining all the objects of note, and then, as H. R. Highness appeared so much interested as to intend seeing every thing, the Secretary attended to afford any explanation which might be needed. H. R. Highness, who has recently become an honorary member of the Institution of Civil Engineers, remained nearly an hour in the rooms, and won the good feeling of all, by his affability; on leaving, he expressed himself highly gratified by the reception he had experienced from the President and his guests.

The Duke of Wellington arrived immediately after H. R. Highness' departure, and went the circuit of the rooms. making his usual prompt and sagacious remarks.

Among the distinguished visitors we noticed particularly the Dukes of Wellington and Buccleuch, the Marquis of Northampton, the Earls of Devon, Lincoln and Courtenay, Lords Lovelace, Blayney, Lowther and Blantyre; Hon. C. Wood, M.P., Hon. W. B. Baring, M.P., and numerous members of Parliament. Engineers, Architects and Professors, and several eminent foreigners.

Our limits will not permit us to notice everything, but we must select a few of the most interesting objects. In the principal room was a marble group by Bailey, of great simplicity and beauty, some good sketches by Stanfield, Oliver, Stephanoff, Harding, and Kendrick. Scanlan contributed some sporting and military subjects in his usual happy style; some fine bronzes from Deville's collection; and in all the rooms were to be seen some exquisite specimens of wood carving from Rogers of Great Newport Street. The Bank machine for weighing sovereigns, invented by Mr. Cotton, the governor of the Bank of England; its action was explained by Mr. W. Miller, who has charge of it at the Bank: its delicacy and precision appeared to be fully appreciated. Casts of figures and busts by Bailey, Park and Behnes. Two busts of Mr. Field the eminent engineer and Mr. Davison, of Belfast, by Mr. Jones, were particularly noticed, on account of their faithful similitude to the originals, as well as the artistical feeling they exhibited. It is to be regretted that Mr. Jones does not convert his engineer's office in Cannon Row into a studio, and adopt the career of sculptor and modeller, which he has so auspiciously commenced, and for which his versatility of talent appears so peculiarly to have fitted him. The Duke of Wellington with his usual discernment, made many enquiries about the artist, and appeared much struck on learning that he was an amateur. There was an excellent medallion of Sir Isambard Brunel, by Warrington; Salter contributed some architectural models. Mr. Dent's chronometers, and Professor Wheatstone's galvanic engine occupied the room immediately preceding that in which the mechanical models were placed; and here we can scarcely pretend to particularise from "*l'embarras de richesses.*" The splendid model of the *Great Britain* iron steam ship, 320 feet long, now building at Bristol, occupied the centre table; around it were grouped Cooke's electro telegraph at work, conveying messages; Whitworth's street sweeping machine; Palmer's corrugated cast iron roofs for ship building sheds; Tweeddale brick and tile machines; Rennie's beautiful boat the *Mermaid*; Clark's miser for sinking wells; the Jacquard loom worked and explained, in his usual able manner, by Mr. Cowper; Fairbairn's models of marine steam engines; a planing machine by the Butterley Iron Company, cutting iron with Mr. Babbage's ingenious tool-holders; Mr. Smith's (Deanston) mule jenny, for cotton spinning; tools from Mr. Holtzapffel; models of bridges from Mr. Green of Newcastle, and Mr. Coulthard; an ingenious but simple model for measuring water on a large scale by Albano, adopted at Lombardy; cases of specimens of Minton's beautiful encaustic tiles. We cannot enumerate more although scarcely half through our list.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

On the Principles of Architecture as laid down by Vitruvius.

By W. W. Pocock, B.A., &c., Associate.

Abstract of a Paper read March 6, 1843.

Vitruvius begins his first chapter by considering architecture as a science, embracing theoretical and practical knowledge, to the latter of which he devotes the last part of his 1st, and the whole of his 2nd, 7th, and 8th books. In his 2nd chapter he treats of it as an art of design, or the *ratiocinatio artis*, as he elsewhere calls it, and lays down the principles by which every architectural composition should be tested, and in the 3rd he adverts to the *opus* or mechanical execution of the design.

The 2nd chapter, which forms the immediate subject of this paper, has been a stumbling-block to commentators and translators more perhaps than any other part of his writings. Barbaro, Scamozzi, Philander, Poleni, Perrault, Orsini, Jean Martin, Newton, and Gwilt, have all fallen into errors more or less gross in their comments and translations. Nor is this to be wondered at, considering the ambiguity of his style arising from the abstract manner in which he treats his subject, and the little knowledge we possess of the terms of art and modes of study of the ancients. The principles of composition which he would have us ever keep in mind in the formation of a design are six—ordination, disposition, eurithm, symmetry, decor, and distribution.

Ordination he defines as "the adjustment of the sizes of the several parts to *their uses*, and to the general scale of the building"—"Ordinatio est modica membrorum operis, commoditas separatim, universæque proportionis ad symmetriam comparatio."

Perrault and Newton have quite altered this part of the text of their author, the former confessedly and without authority; whilst Martin, Galiani, Sir H. Wotton and others have been at a loss to comprehend what *ordinatio* meant, though it evidently stands for that principle of our art which teaches us to give to the parts of our designs their appropriate size; for instance, to the several apartments *sufficient* area for the purposes to which they are dedicated, without making them disproportionately large for the rest of the structure; it requires us to give to our doorways, corridors, stairs, &c., sufficient width for the number of persons likely to frequent them; to our windows size sufficient for the due supply of light; to our supports sufficient but not excessive thickness or strength, &c. &c.

Disposition, or διαθεσις, he defines as "a convenient collocation of the parts, and a desirable effect in the composition (putting together) of the work with respect to quality." As then ordination proportions their sizes, so disposition arranges them with reference both to their use (apta collocatio), and the general effect of the composition.

Eurithm, Vitruvius says it is "a sightly appearance, and a suitable look in the composing of members, (*i.e.* forming them out of their simple elements,) and is secured when the members are of a height suitable to their width, and of a breadth proportioned to their length, and, in short, when all things accord to their own proportion;" *omnia respondeant suæ symmetriæ.* "So symmetry," he adds, "is a proper concord of the members of the work itself, and the accordance of any given one of the several parts to the appearance of the general form."

Eurithm then regards the ratios or relations of the dimensions of any single member, and symmetry the relations of one member to another, or of any given dimension of one member to the corresponding dimension of another. Proportion is therefore of two kinds according to Vitruvius, viz.: eurithmic and symmetric—a distinction lost sight of by all his annotators. The former exists between the height of a column and its diameter; the latter between the height of the column and the height of the entablature, and also between the diameter of the column and the width of the intercolumn. Eurithmic proportion obtains between the width and height of a door or of a window, symmetric between the door as a whole and the window as a whole, and between the widths and the heights respectively.

Decor-consistency or propriety, he defines as "a correct aspect of a work composed of parts, approved with reference to precedent or authority, and is threefold, as it relates to statio (θεμα τισμο) custom or nature. The first translated "station," "circumstance," "stanza," "abitazione," "*situation d'un-lieu*," "*etat des choses*," "*statuo*," by Newton, Gwilt, Barbaro, Orsini, Martin, Perrault and Galiani respectively is exemplified, when temples to Minerva, Mars, Hercules, &c., are executed in the Doric order as suited to their stern attributes, and shrines to Flora, Venus, &c., in the Corinthian style to accord with the tender and delicate natures of these latter divinities. Conventional propriety, he says, forbids the infringement of usages approved in all ages, for instance the introduction of triglyphs into any other order but the Doric, or of Dentilo into this.

Distribution, his sixth and last principle, he explains as "an advantageous dispensation of the materials and site, and a careful and rational regard to economy." As a further explication of his meaning, he adds the Greek term *οικονομια* as a translation of distributio, a word more nearly equivalent to "stewardship," than to any other expression in our language. From this we may understand that it is the province of architecture under this aspect to furnish all the requisite parts of the design without lavish expenditure, but in such manner and measure as may be best afforded by the circumstances of the case.

These then are the principles of architectural composition which Vitruvius lays down. Ordination, by which the parts are made of a size appropriate to their use; disposition, by which they are placed in convenient and effective collocation; Eurithm, or the due proportion of the parts, each in itself; symmetry or unity of proportion between all the parts and the whole; propriety, or consistency and distribution or economical provision of all the essential requisites.

In this analysis we scarcely know which to admire most, its completeness and neatness, or the beautifully natural and correct order in which the elements are exhibited. No part is deficient—none redundant. Were ordination neglected, the parts would be some too small for their destined uses, and others equally too large; in other words, the utility of the structure destroyed by this one defect; without attention to distribution, it will be rendered equally useless by the inconvenient arrangement of the whole, whilst a disregard to either eurithm symmetry or decor will render it displeasing alike

to the observant eye, and the contemplative mind. The apartments though of sufficient area, might be too low or too long for their width to be elegant or noble, though sufficient light were obtained it might find its way through very ill-proportioned windows; the entrance though wide enough, might be inelegantly low or absurdly high; the vestibule though large enough for mere use and appropriately situate, might not be in keeping with the spacious saloons. Yes, a design though correct in all the above particulars, might prove to be abundantly too expensive for execution, or when executed, useless; because, forsooth! there was no staircase to the upper floors; or, if a palace, no state rooms in which to hold the levees.

That design, however, which gives appropriate size to all its parts justly arranges them, preserves the beauties of eurithmic and symmetric proportion without outraging propriety; incurring irrational expenditure, or omitting any of the essential features, is as excellent as the rules of art can make it, and requires only a due infusion of natural talent or genius to render it perfect.

Whence it follows that the text of Vitruvius in this part, at least, is not as Shultz and others, his lickspittles, have called it, "sophistical twaddle put together by an ignorant compiler,' but a beautifully perfect, concise, and consistant explication of the subject in all the views in which it can be regarded, and worthy of our highest admiration.

THE NATIONAL ADVANTAGES OF FRESCO PAINTING.

Abstract of a Paper by James Thomson, Fellow.

The Institute has been already favoured with two very interesting papers on the subject of Fresco painting. One by Mr. Parris (*Journal*, vol. 5. p. 95.) conveying many useful suggestions on the practical working of it; the preparation of the ground or plaster best adapted to the purpose, and the colours of which the chemical properties alone will combine with the material, without risk to the artist who uses them. Another by Mr. Severn (*Journal*, vol. 5., p. 188 & 310), setting forth in most animating terms the works of the Italian masters. No sooner was the art of Fresco painting thus introduced, than Mr. Thomson was led to consider the importance of it to architecture in particular—to the art in general, and as he was prepared to show, to the *nation* at large. He thus continues —First, its advantages to architecture in particular. In this a great and primary benefit is, that it applies itself to those broad spaces of the interiors of buildings, which, if decorated in any other way, either become monotonous, or (if not monotonous), too laboured and costly to be often indulged in. and secondly, to supplant the meretricious style of modern decorations. At present embracing these two objects—the filling up of the internal surfaces of building, and the exclusion of details that are foreign to the edifice—I would observe That the simplicity and purity of fresco painting demand the sober dignity of architectural forms and proportions, and would be utterly at variance with the tawdry patchwork of every day practice. To place a fresco of Michael Angelo's, Raffaele, or A. Del Sarto, in a modern gilded frame work, would at once exhibit the impertinence of such an association; and there are special reasons for this. The superior *transparency* of fresco pictures causes them to *reflect* light, while oil paintings *absorb* it; and again, the former in which, simple colours and grand outlines only are admissible, can dispense with such accessions, while the other by its extremes of depth (amounting frequently to blackness) and high lights, introduced at pleasure, requires the aid of some such boundary. A gilt framework is almost *indispensable* to an oil picture—while to a fresco (on account of its own brilliancy) it is not only *unnecessary*, but almost *injurious*. I shall illustrate this, by quoting examples well known to all who have visited the continent. In three of the most admirable works of the Italian school—and each of them by masters of rival excellence, Michael Angelo, Raffaele, and Guido—scarce any gilding has been employed. For instance, in the ceiling of the Sistine Chapel; the ceiling of the Farnasine Palace, and the "Aurora" in the Ruspigliose Palace at Rome. in neither of these do we find gilding to be much if at all existing. But there are other points to establish the affinity of fresco painting to architecture, and it is to be found in the necessary proportions of parts to each other, so that they may not only be good in themselves, but as integral parts of a uniform whole. To explain this, we must now refer to the labours of another great painter, A. Carracci, and place his great work at the Farnese Palace, beside the still greater production to which I have before alluded, the ceiling of the Sistine Chapel. In the former will be found that however bold and versatile are the decorations, there is an absolute want of subordination of parts to each other; the oblong forms (intended to be principal) are nearly equalled by the square ones—and the square compartments are almost overpowered by the medallions. There is a struggle as it were for preponderance, even the figures contained in each of the latter panels appear to occupy a secondary place. Now let us turn to the Sistine Chapel. We here find all the parts, whether panel, pilasters, or figures, to subserve the principal objects. Here are the Prophets seated on pedestals in sober majesty, and they are surrounded by figures in every variety of attitude—and such attitude indicative of some important office—yet all contributing by their subordination to the dignity of the sacred seers. The side compartments are here decidedly less than the central, and the medallions are comparatively small. And then how charmingly does the artist's eye direct the allusion. Some of the figures are 12 feet high, others not more than 3 feet, and though close beside each other, no confusion results. One is turned into bronze, another into stone, and the third represents life; but the artist had yet another and another handmaid—perspective and foreshortening, a branch of perspective, and aerial perspective. But if in point of beauty fresco painting stands unrivalled, what shall we say of its durability? It has been urged that the damp air of this country is unfavourable to it, that our walls steaming with condensed vapours would soon cause the labours of the artist to suffer damage and ultimately disappear. Now what have we to oppose to this? If fresco was like stucco painting, the objection would hold—the latter lies upon the surface; but as the former is indurated, and becomes a part of the material of the stucco itself, we know that is liable to no such contingency, but that on the contrary it is the most lasting of any style of painting whatever except it be enamel. We will prove this by past experience and analogy. True it is that the *climate* of Italy will afford us no criterion—but its *fatalities* will.

We are all more or less acquainted with the elegant frescos of Pompeii. These delicate productions are, we know, after a lapse of more than 1800 years, preserved to us in all their pristine freshness; now, it cannot be urged that their buried state was favourable to them, or if it could, it would be to establish another advantage over oil painting. What pictures in oil, whether on canvass or copper, could have stood the test which they have?

The most important division of the subject, is—the economy of Fresco painting as compared with the present waste by gilding. Adam Smith, in his "Wealth of Nations, says, "In the manufactories of Birmingham alone, the quantity of gold and silver annually employed in gilding and plating, and thereby disqualified from ever afterwards appearing in the shape of those metals, is said to amount to more than £50,000 sterling.

It is not here intended to object to the judicious use of gold, but to the abuse of it; nor either to the cost of gilding, but to the actual waste by gilding plaster and composition, and every description of worthless material. But, lest it should be supposed that the withdrawal of gilding from our interiors should have the effect of throwing large number of workmen out of employ, Mr. Thomson proceeded to show that it would be the sure means of giving occupation to hundreds and thousands that now seek in vain for it. The moment the use of gilding is restricted, increased aid of ornamental painting will be required, and the art of Polychromy will be revived; and it will, also, require further aid from the carvers, and sometimes the chasers. Mr. Thomson then proceeded to make some remarks on the vast quantity of gold used for gilding, and the number of hands engaged. and the cost. He then explained by what means fresco should be advanced,

"The first legitimate source," observed Mr. Thomson, "appears to me to be in our churches, because the talent of our countrymen could not be better engaged than in the suitable advancement of their Christian temples. The next source that suggests itself for the promotion of fresco painting is, our Art Unions. They cannot, indeed, draw lots for frescos before they exist; nor can they be ready made as easel pictures for competition, but they can do this: they can give encouragement to that lofty branch of art which is capable of being transferred to fresco by engravings, duplicates of which are secured to the candidates. The third, and not the least important means of its advancement, I would refer to, is—individual patronage. I would remind those whose exalted station can alone derive lustre by the services they are able to render their country—I would remind them, how much it may be in the power of one noble house to effect."

We have it in history, and that of the dark ages, that "when Italy was torn by intestine factions, and war raged through the length and breadth of the land, that even this turbulent epoch was most glorious to the fine arts. In the midst of battles—engaged in the mortal struggles for the existence of his country, we find M. Angelo constructing the defence of his native Florence—fighting on the ramparts, and at the same time producing those marvellous specimens of art which have immortalised his name.

"Coeval with him we have the bright galaxy of talent which illumined Italy, so that, in the course of nature, one person might have lived to see them all. Born with Titian in 1477, he might have passed his life with Michael Angelo, Leonardo da Vinci, Raffaele, Corregio, Georgione, Tintoretti, Bassano, Paul Veronese, Gilio Romagno, and Andrea del Sarto—he might have outlived them all, and, even within the ordinary limits of human life, have witnessed the close of M. Angelo's brilliant career in the year 1563. Such was the rich harvest, which left but slender gleanings to succeeding ages. It had shot up and ripened in the midst of storms, and seemed, like the palm tree, to gather strength from the difficulties opposed to its growth—to spring with vigour in proportion to the strength employed to bear it down."

It is added—"The stimulus which gave it life and energy to brave these adverse circumstances—was the encouragement and foresight of *one* enlightened family—The Family of the Medici."

WILTSHIRE TOPOGRAPHICAL SOCIETY.

The third Anniversary Meeting of this Society was held on Saturday, the third of June, when the Lord Bishop of Salisbury presided. It was then reported that "the first volume of the society's publications would be ready for the members early in July—that it would contain the Rev. J. E. Jackson's *History of Grittleton*, and Mr. Britton's *Introductory Essay on Topography*, with Glossaries to Domesday Book, and other Archæological Records, &c.; and that the volume was exclusively for the members of the

society." It was further reported that other works were in progress, and that it was expected, one, two, or more volumes would probably be ready by the ensuing anniversary. The only alteration in the list of officers was the election of A. Caswall in the room of F. Whitmarsh.

KING'S COLLEGE, LONDON.—OPENING OF THE NEW MUSEUM.

The opening of the museum of this noble establishment took place on Thursday the 22d ult. under the immediate auspices of His Royal Highness Prince Albert, who arrived at the college punctually at 12 o'clock, he was received by the Bishop of London and Archdeacon Lonsdale, the principal of the college, and led into the grand hall which is quadrangular, and has two large staircases on either side, with a gallery or corridor above. These were all lined with students of the college and of the school, who, together with the council and professors formed rather an imposing coup d'œil.

Among the company we observed the Archbishop of York, Bishops of London, Norwich, and Gloucester, and many other dignitaries of the church, Lords Brownlow, Radstock, Sir Robert Inglis, Mr. Faraday, &c. &c.

After the repeated hurrahs and cheers had subsided, Mr. Slater, one of the students, advanced to the Prince and read a Latin speech, and at the close, Mr. Hullah's pupils, who lined the right hand staircase, broke out and sung our national anthem "God save the Queen."

The Prince, attended by the principal of the college and the Bishop of London, then ascended the staircase for the purpose of opening the new museum. On his way he inspected the Marsden library, so called from the presentation of a most valuable collection of works in the Eastern languages, by Mr. Marsden, and the grand library, which, though small, contains some of the most select classic authors in ancient and modern literature. On His Royal Highness's arrival at the new museum, he was joined by the Crown Prince of Wirtemburg and suite, and was received by Professor Wheatstone, who accompanied His Highness through the museum, and explained the various apparatus, with all of which the Prince seemed well conversant, and much interested. The museum is to be attached to the engineering department, it consists principally of instruments from the royal collection at the Kew observatory, formerly belonging to King George the Third, many of which were of his own workmanship, and it has been since further enriched by royal munificence and by private liberality, in the presentation of Babbage's celebrated calculating machine; models of well known bridges, and of the most ingenious and difficult engineering works, and also a statue of George the Third, by Tarnerelli, presented by H. Pownall, Esq., and it is hoped that it will become the nucleus for the formation of a scientific museum, which the manufacturer and man of science will frequent, and where all models and inventions of known utility will be sent for their inspection and approval, and for the publicity that they will thus obtain.

After the ceremony of opening the museum, the Prince proceeded to the great theatre and its ante-room, the one containing a small but choice collection of birds, and the other a valuable present from Her Majesty, of English and foreign insects and butterflies. This theatre, which is the large theatre of the institution, was filled with an assemblage of the highest rank and fashion. The Prince was here attended by the lecturer, Mr. Cowper, who explained various models and drawings. A valuable full length likeness of Jacquard, the inventor of the celebrated Jacquard loom, woven in silk, very much attracted the attention of his Highness, it was scarcely to be distinguished from the finest engraving: the whole process was fully detailed by the lecturer, the Prince entering warmly into the detail of a machine whose results had been so beautifully displayed in the specimen before him. The *Times* printing press, spinning and other models were also severally explained; afterwards his Highness proceeded to the theatre of Materia medica, and the chemical theatre where he was received by Prof. Daniel who explained several interesting experiments connected with the voltaic battery, and the decomposition and formation of water, he then adjourned to the terrace of Somerset House where the experiment of letting off a cannon on the top of the shot tower on the opposite side of the river Thames from a galvanic battery on this side of the river was to have been performed: this did not take place; but we could not positively ascertain wherefore; we believe the communication of the wires passing across the river had been destroyed. After parading the terrace attended by the principal, the Prince retired to his carriage evidently much gratified with the strong expressions of loyalty that he had met with, and the many interesting experiments he had seen.

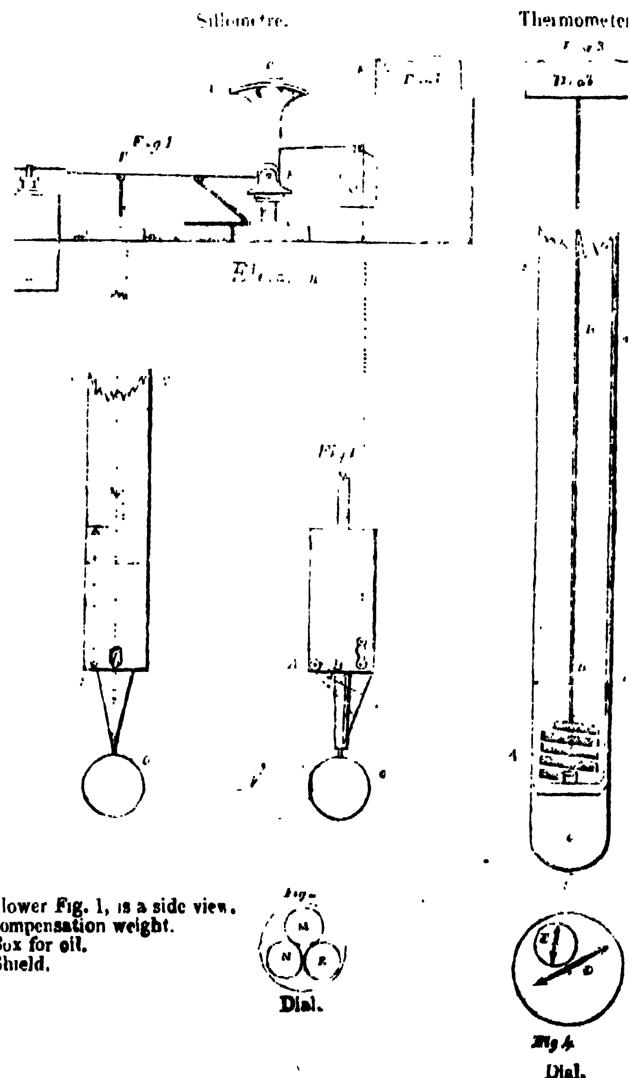
We believe we are authorized to state, that the public are at liberty any time between the hours of 10 and 3 o'clock to visit the museum The or parts of the college.

M. CLEMENT'S NAUTICAL INVENTIONS.

In the *Journal* for last January, page 28, we gave an account of M. Clement's ingenious inventions, together with some particulars respecting an experiment, made by order of our government, to try their merits; since then more extended experiments have been made in H. M. steam vessel *Blazer*, which has proved very successful; the results, communicated by Captain Washington, R.N., are to be found in the *Nautical Magazine* of last month, from which we have obtained the following description and drawings of the instruments.

The name *Sillometre* is composed of the two French words *sillage* (headway) and *mètre* (measure), and might be well rendered in English Speed-gauge. This instrument consists of a hollow copper ball O, Fig. 1, about five inches in diameter, suspended under the ship's bottom, nearly amidships, from the middle of a bent lever A C, about five inches long; one end of this lever moves on a joint A, its fulcrum, attached to the lower end of a metal rod which passes vertically through a copper tube carried from the deck through the bottom of the ship near the keel; at the other end of the lever is attached a chain C, which leads upwards and acts upon a second horizontal lever E F, on deck. This second lever corresponding to the lower one, gives motion, by means of a spring, to an index which marks on a dial the speed of the ship expressed in knots and tenths of a knot.

Such is the whole of the apparatus of the simple Sillomètre. It will be readily understood that as the vessel moves through the water, the fluid acts upon the ball, which being circular, always presents the same section, and causes it to move aft, thereby depressing the fore end of the lever which by the chain communicates with the dial on deck. The scale by which to graduate the knots on the dial was found by M. Clément after numerous experiments. This instrument in its simple form shows the speed of the vessel, not the amount of distance run.



The lower Fig. 1, is a side view.
Q, Compensation weight.
, Box for oil.
Z, Shield.

The compound sillometre consists of the same mechanism, Fig. 2, with this addition, that the power which moves the index M, is applied at the same time to a watch N, and accelerates its movements in proportion to the intensity of the moving power, or as the vessel quickens her speed. A second watch R, is placed by the side of the first, in order to show how much the former gains upon the latter; and knowing that for every six seconds of gain the vessel will have made a mile, it is easy to know the distance run. It is evident that this compound instrument is very superior to the simple one, but its accuracy depends upon the regular going of two good watches, a result not very easily obtained at sea.

The *Sub-Marine Thermometer* is a very delicate instrument composed of a ribband formed of two metals of unequal contraction and expansion, as platina and silver, and rolled in the form of a helix A, Fig. 3, round an axis B, which turns as the temperature of the water varies. This motion by a train of wheels and pinions is immediately communicated to two pointers on a graduated dial on deck, and which may be read off easily to hundredths of a degree.

The whole of this apparatus is enclosed in a metal tube, which passes through the bottom well aft in the run of the ship. The helix or thermometer is therefore always at a certain depth in the water, say 10 feet below the surface, and it shows instantly every change in its temperature.

As few observations have been regularly made on the temperature of the water of the sea at a certain depth, this machine may lead to some novel results.

The *Steam Indicator* points out the temperature and consequent pressure of the steam in the boilers. It is composed of a ribband or blade of two sensitive metals of unequal expansion, turned in a spiral form; one end is fixed to the tube or pipe in which it is contained, the other connected with a spindle bearing the pointers which indicate the temperature of the steam on a dial on deck, in degrees and tenths of a degree. This instrument is connected by a small pipe with the boiler or steam chest through which the steam reaches the spiral, which instantly causes any variation in temperature to be shown by the dial on deck. In high pressure engines this may be found useful.

The *Derivometre* is an instrument somewhat on the principle of the sillometre, and intended to measure the drift of a ship; this is done by a vane placed on the keel, connected by a rod with a dial—the vane of course takes the opposite position to the drift of the vessel, which is communicated by the turning of the rod to the pointers on the dial on deck.

The *Internal and External Thermometer*, as its name indicates, is a highly sensitive thermometer so placed against the wall of an observatory or house, as to show the temperature of the air within and without. The two pointers which mark this are on the face of the same dial.

The report and log show that the sillometre indicated every variation in the speed of the vessel, even the alteration caused by a single spoke of the helm was perceptible, and putting the helm hard over caused the ship to lose half her way almost immediately. As the dial of the instrument is placed on deck, and the index or pointer very conspicuous, the officer of the watch without any trouble may observe it at every turn he takes on the quarter deck, and it is obvious that none but the most inattentive person can fail to have a much more correct knowledge of the rate of the vessel's going than he can from heaving the common log once or twice an hour. The sillometre will also enable an officer easily to ascertain the best trim of a vessel, the difference caused by shaking out a reef or by making or shortening sail, and in a fleet would enable a ship to keep her station by night or by day with great steadiness, and lastly it impresses very strongly on the observer the absolute necessity of good steering and giving very little helm when in chase or on a trial of sailing, or at any other time when speed is of importance.

The Steam Thermometer has also a dial placed on deck so that the officer of the watch can tell at any moment whether there is a sufficiency of steam or the contrary, and can thus check the wasteful expenditure of coal; it would point out too the possible, but highly improbable occurrence of no water in the boilers, or an undue increase of the temperature of steam from any other cause. Its chief value however would be shown in a high pressure steam engine when it would give immediate warning of any approach to such a degree of temperature or pressure as might be dangerous.

The Sub-marine Thermometer remains constantly at a depth of about ten feet below the surface of the water, and owing to its being formed of platina and silver is extremely sensitive, and thus every change in the temperature of the sea will be shown at once on the dial on deck.

As in the Atlantic Ocean and other deep seas, the deep water is said to be warmer than the shallow, it probably would there show, by mere inspection, the approach to shoals, rocks, or land, and serve as an excellent warning. At this season of the year however in the shallow waters of the North Sea we observed no such effect, on the contrary the temperature of the water gradually decreased from 50° Fahrenheit at Woolwich to 44½ at about 20 miles to the eastward of the North Foreland, and as gradually increased on our return to the same point.

Possibly as the summer advances this may be different, and in order to discover when the change of temperature takes place, I have directed the instrument to be registered every two hours night and day. As the thermometer is highly sensitive and may be read off with ease to hundredths of a degree, and agrees perfectly with the best mercurial thermometers, it may possibly furnish some novel results of value to the philosopher as well as to the navigator, since I am not aware of the existence of any continued series of observations on the temperature of the sea at all seasons of the year.

WESTMINSTER BRIDGE.

Report to the Sp[illegible], by Messrs. Walker *and* Burges, *on the alterations proposed by* Mr Barry.

Sir, As that portion of Mr Barry's report to His Royal Highness Prince Albert (on the decorations, additions, and local improvements connected with the new Houses of Parliament) which refers to Westminster bridge may naturally lead to the opinion that our plans, made under the direction of the Bridge Commissioners, were confined to the repairing and extending of the foundations, for our superintendence of which he kindly compliments us, we consider it, therefore, a duty to prevent such a mistake by stating, that the designs, estimates, and the contract with Mr Cubitt, included the repair of every part of the bridge, the "removal of the present steep and dangerous acclivities, and the lowering of the parapet and road-way to the lowest possible level" that appeared at the time to be consistent with the safety of the present arches. The second contract with Mr Cubitt, is for lengthening the piers, which are being carried to above high water level, to receive arches for widening the bridge twelve feet. It will then be of the same width as London bridge. All, in fact, that we have done to Blackfriars-bridge, is designed and contracted for, to be done to this bridge, with the very important addition of the preparation for widening. The steepest part of Westminster-bridge road-way will, when the designs are executed, be as easy as that of Blackfriars-bridge. That which rises one in fourteen, will be reduced to one in twenty four, and even this rise will be for only a limited length.

To secure the foundations, which were in danger of being undermined by the scour consequent on the removal of old London bridge, has been the first object. The supposed difficulty of doing so effectually, was increased by the opinion entertained by Labelye, the original engineer, and others since his time, that owing to quicksands, coffre-dams could not be applied; and the commissioners have been desirous of removing all doubt on this point, before proceeding with the spandrils, road-way, or parapet. Five out of the seven coffre-dams have been built so far, we have been completely successful, and while the water was excluded, all the work which was required in repairing and lengthening the piers to above high water, has been done; seven out of the thirteen arches have also been repaired, as the coffre-dams gave facility for the scaffolding necessary for doing this. Thus far, therefore, our design proposed to, and approved by, the Commissioners, corresponds with, and has anticipated Mr Barry's, but the idea of taking down the present semi-circular, for the purpose of substituting pointed arches upon the same foundations, is not ours, and we beg to state shortly, why we do not concur in the expediency of this proposal.

Mr Barry's first argument for this change is, "that the pointed arch will enable the road to be lowered, by materially reducing the thickness of the crown of the arches, within what is considered necessary for arches of a circular form." Now, we consider that the whole thickness of the stone work and covering of the present centre arch may be reduced to about seven feet, which is the same thickness as Mr Barry's ribs, arch and covering, measured upon his section; so that, even supposing the principle he states, of the pointed arch requiring less thickness than the circular arch, to be correct, he obtains no reduction in thickness, and only lowers the road-way, by lowering the soffit of the arch. The generally approved theory of arches is

* The commissioners have power to suspend or supersede the contract in respect of any works not commenced.

however, directly at variance with Mr. Barry's. In "Pratt's Mathematical Principles of Mechanical Philosophy,"—considered a standard work, and, as we are informed, a text-book at Cambridge,—the theory is so clearly explained, that we give it in his own words: "A pointed arch," he says, "must have a great pressure on its crown to prevent its falling, because it may be considered as consisting of two extreme portions of a very large circular arch brought together, so that the pressure on the crown must at least equal the pressure of the portion of the circular arch which is removed. Flying buttresses always have a great pressure upon their highest part. The pointed arch will sustain almost any weight on its crown, provided the lowest stones do not give way, and, consequently, the Gothic arch is stronger for lofty buildings than the circular; but the circular arch is far better adapted than the Gothic arch for bridges, since the pressure of weights passing over may act upon any part of the arch, not only on the crown." Mr. Whewell comes, in different words, to the same conclusion; and the same can be deduced from Attwood, though not so clearly expressed. These are no mean authorities; indeed, we do not know an exception in any author, British or foreign, to the opinion, that the pointed arch requires a greater thickness of material at the crown than the circular arch to keep it from rising; and if so, the substitution of the pointed arch should, in place of allowing a reduction, demand an addition to the least thickness required for the present arches. Add to theory, the experience of every modern engineer of this or other countries, as shown in their bridges of any considerable size: for we are not aware of any example of a pointed arch for a bridge of any magnitude in the works of Smeaton, Rennie, Telford, Perronet, or indeed of any other.

Mr. Barry's second argument for substituting the pointed arch is—"the elevation of its springing above the level of high water, by which the water-way of the bridge will be the same at all times of the tide, in place of being contracted by the present spandrils at high water, nearly equal to one-twentieth of its sectional area, occasioning currents, with a fall, and sometimes danger to craft in passing through the bridge under the influence of high winds." Mr. Barry appears here to have stated "sectional area," when he must have meant width or chord; for we find, that in the section of his scheme, the contraction of the middle arch by the spandrils is about one-twentieth of the width, at the level of Trinity high water: but as the contraction is only a few feet in depth, before the arch falls into the vertical line of the pier, the diminution of sectional area is not one-twentieth, nor more than one one-hundred-and-twentieth, and this at high water only;—and even this small diminution is in effect reduced practically to nothing as respects the current, when it is considered, that the greatest velocity does not take place until half ebb, by which time the water has sunk below the level of the spandril. It is, we think, therefore evident, that the proposed alteration will not produce any useful effect upon the currents or the falls. When the bed of the river under the arches is lowered (which also is part of the contract), and the coffre-dams removed, the present current through the bridge will be materially lessened. Some practical good would be effected by the higher point of springing of the pointed arches, in giving more head room for craft near to the piers; and, as the Westminster-bridge arches have less space for navigation than any of the four City bridges, any increase of accommodation is desirable; unfortunately, however, while an addition is thus made for one-fourth of the width of the arch near the springing, a portion is taken away from the height for the remaining three-fourths, nearest the crown, where it is of the greatest importance; this diminution varies from eighteen inches to thirty inches; so that the centre arch will not then have more height for navigation than the two arches, adjoining the centre arch now have; and when we inform you, that at high water of good tides, the centre arch is the only one which some of the steamers can conveniently pass under, we think you will allow with us, that the proposed lowering will, in such cases, be rather a practical evil, as it will take from the convenience of what is now the least convenient bridge for navigation, to say nothing of the liability to the ribs being injured by masts and chimneys striking them.

The *artistic* point of view is the last insisted on by Mr. Barry: and on this, what we may say, is with a due respect to his better judgment and taste in matters of architecture. The contract with Mr. Cubitt does not alter the present elevation below the crown of the arches; but, as you are aware, we have long since suggested that a new elevation for the bridge after the Norman style would be a great improvement. In this, however, we would not propose to reduce the magnitude of the features of the bridge, considering that simple boldness, and strength, are essential qualities in a bridge over the river Thames, in London; and if so, that it is scarcely fair to reduce the parts of the bridge because those of the elegant florid edifice, which is now being an... near it, are small. For palace architecture, the latter may be the best, and we do not venture an opinion as to the effect of Mr. Barry's work, in which our professional employment was confined to the construction of the coffre-dam and the river wall; but for a bridge, particularly in a city, with constant and heavy rough trade under and over it, the style of architecture ought, we conceive, to be more masculine. May not the new houses be better displayed thus, than by accordance of style? The beauty of the detail of the new houses is very great; the length 800 feet, without, at present, any striking feature or variety, also great; but we submit, whether an additional 800 feet of according composition and style, of still lower elevation, would not rather tend to render the "ensemble" dull and flat than effective? The style of the new buildings must stop somewhere. Can it do so better than at the bridge, which, as we have already said, appears to require a character different from the Houses of Parliament? If both faces of the arches are proposed by Mr. Barry to be alike, would there not be a want of accordance between the north face of the bridge and the buildings and mansions near to it, and which there is, we presume, no intention of altering? Is a continuance of the same style required for so great a length, as the houses and the bridge together, although the pointed may be the prevailing character of the building? Does not precedent reply to this in the negative, and prove it, by the fact that the periods of the original erection and of the additions that have from time to time been made to some of our finest buildings may be discovered by the style; the Saxon, the Norman, the Pointed, and varieties of each being found in the same building, and yet the "ensemble" not inharmonious. We hope, therefore, that the superstructure of the bridge, though it may be different in style from the Houses of Parliament, may not be discordant.

Westminster-bridge has been where it is, and as it is, for a century: it was there when the designs for the new houses were made, and we never heard that to pull down Westminster-bridge to nearly low water, was to be a necessary accompaniment to the adoption of any of the designs. If you and the other commissioners had known that such alterations were contemplated, you would not, we are sure, have allowed the works to have proceeded as they have done, until nearly two-thirds of the whole to above high water had been completed, including the renewal or repair of the arch stones.

We may name here an objection to the form which Mr. Barry has proposed for the arches, as tending to lessen the stability of the bridge. Labelye considered that by adopting the semi-circular arch, which presses vertically upon its piers, each pier might be considered an abutment, so that if one arch were to give way, the piers would support all the others. From the great height at which the proposed pointed arches spring from the piers, and their greater lateral pressure or thrust upon the piers, the above would not be the case. On the contrary, the failure of one arch would, we conceive, cause the destruction of all the piers and arches. This consideration is not to be disregarded in a bridge, the piers of which have been so badly founded, that to support them has been a constant expense, and is at this moment a source of considerable anxiety; although the works we have in hand, if as successful as hitherto, will render the piers much more secure than they have ever been; we hope, perfectly so.

On the whole, therefore, we have reason to be pleased, that Mr. Barry approves the various improvements in the bridge which the commissioners have contemplated, and, with one exception, contracted for. The only addition he makes to them is, the substitution of the pointed arch, which, for the reasons stated, we cannot advise. We agree to the advantage, in point of taste and utility, of keeping the road-way of the bridge low; we have designed doing this as far as can be done, having regard to the funds of the commissioners, and therefore without disturbing the present arches. There is a way by which the height of the road-way might be reduced below what either Mr. Barry or we have yet proposed, at one-fourth of the expense of his plan (which would, we think, much exceed his estimate), and without lowering the soffit of the arch, or diminishing in any way the convenience of navigation; but we avoid entering upon, or committing ourselves to this, until we have considered the subject more in detail, and understand it to be the wish of the commissioners that we should do so; for the works we have already recommended may go as far as their unassisted funds would justify.

We have the honour to be,
Sir,
Your obedient servants,
WALKER AND BURGES.

23, *Great George Street*,
31st May, 1843.

The Rt. Hon. CHARLES S. LEFEVRE,
Speaker of the House of Commons,
Chairman of the Commissioners of Westminster Bridge.

NOTES ON EARTHWORK, &c., UPON RAILWAYS.

ARTICLE 7. CAPITAL, SHARES, AND TRANSFERS.

The previous papers that have appeared in the *Journal* on the above subject, have reference to the constructive operation in the formation of railways, which is more in my line than the title or heading of this paper; yet, I am induced, however imperfectly, to give some account of the ways and means by which the necessary funds have been raised, as I know of no work where any information is to be obtained, except in isolated and unconnected passages of various works bearing more or less on railways.

The necessity of a railway for the public convenience being fully established, and the probable cost of the works ascertained, the number and amount of shares necessary to be raised is then considered, which are proportioned to the magnitude of the undertaking, the liability of calls being limited to the amount of share. The amount of each share has been generally fixed at 100*l.*; in some instances at 50*l.*, and in a few cases as low as 20*l.* per share, the greater or less amount giving the undertaking a more or less speculative character. The legislature require the whole capital to be subscribed to the deed before any step is taken in the execution of works, and in 1836, to check the mania for railways, a standing order was passed requiring ¾ths of the cost of the undertaking to be subscribed for, and a deposit of 10 per cent. paid thereon, before an application could be made to Parliament for a Bill, which was evaded in 1837 by the Edinburgh and Glasgow Railway Companies, who borrowed the money from their bankers, the Company at the same time claiming exemption from the standing order, on account of the project being started before the framing of the order. The amount of capital being fixed, Parliament as a general rule allow a third to be borrowed by the executive as a mortgage. In almost every case the capital has been found to be inefficient for the construction of the works, and application to Parliament a second, third, and fourth time, has had to be resorted to, and fresh powers obtained for raising more money, either by issue of new shares to pay off loans, or to obtain further loans on mortgage, or bond on the credit of the company, by way of loan notes, or promissory notes of the director under the seal of the company, also by debentures, which are mortgage bonds according to act of Parliament, the interest of which has preference of any dividend, and if not paid within 30 days after due notice, two justices of the peace may appoint a receiver of the tolls and profits of the railway; and the same course may be taken with respect to the principal, unless paid within six months after it is due. The company reserve power to pay off bonds any time after three or six months' notice. The debentures are very convenient, as interest warrants or coupons are attached for the whole period, made payable every six months at the bankers of the company, during the whole period for which the money has to remain, which is generally for three, five, seven, and never more than ten years, being at the same time transferable like shares, a form for which is provided in the acts of Parliament.

In the second Report on Railways, from a select committee of the House of Commons, printed August 9, 1839, where much valuable information is to be had on this subject, the Committee particularly direct attention to the course pursued by the different companies in coming to Parliament, for the purpose of raising sums rather than enforce payment of money empowered to be raised under former Acts. It has been already stated, that in the second application to Parliament, the companies have been empowered to raise further sums, by issue of new shares, and conversion of bonds into shares. The amount of the shares has been reduced in these cases by the companies, and rendered more speculative in character, perhaps purposely so, by the 100*l.* share being divided into halves, quarters, thirds, fifths, tenths, and so forth. In such straits have some concerns been, that after all means for raising money by bonds or mortgage, and loans on credit of the company, have been exhausted, new shares have been issued at a discount of 50 per cent, and in some instances preference or privileged shares have been created, with a guarantee of interest at the rate of 6 per cent., and bonds have been converted into shares with a guarantee of 5 per cent. in priority of original shareholders, to be received out of the paid up capital of the company.

In only one instance has a public railway been offered for sale by auction, and this was by the seizure of a line by the Exchequer Loan Commissioners, who can suddenly sell to the detriment of all other lenders; but the sale was prevented by an arrangement with Government for the liquidation of the debt and accruing interest, by instalments during a period of 20 years.

Scrip shares are certificates for shares prior to their legal creation, and pass from hand to hand without registration, and are not transferred by deed, the payment of duty on transfer is thus evaded, but registration is necessary to receive a dividend. Privileged or preference shares have a fixed interest or dividend secured upon the paid up capital, in priority of any dividend to original shareholders.

The influence obtained by the possession of a great number of shares, varies in almost every company, but the general average may be about twenty votes for twenty shares, and an additional vote for every five more shares; in other cases four and five shares are requisite to obtain even one vote: and to prevent the leviathan swamping the minnow, no one person is to have more than from 10 or 15 and up to 60 votes; the latter is the greatest latitude allowed in any company. The qualification for becoming a director, is the possession of from 10 to 20 shares, which also differs in various companies. The estate of shares is declared in all railway acts to be personal property, and a form of transfer is prescribed, which, however, cannot be acted on until calls are paid, that is during the collection of a recent call; neither can shares be transferred for some days previous to the general meetings of the company. Shares may be forfeited at general meetings on neglect to pay calls after notice by post, or left at the abode of the owner. The defaulter is subject to be fined for neglect, and three months' notice of forfeiture; but the company must not sell more than will pay the calls that are due. The forfeiture of shares is an indemnity against actions for calls (the other resource of the company against defaulters) and absolve the defaulter from further responsibility after, but not before, forfeiture.

The companies may purchase shares to merge into the company, or to be held in trust; when this is done, and held in the name of individuals, a power is obtained very detrimental to the interest of the small holders of shares. The calls are stipulated in the acts of Parliament to be made at intervals of from sixty days to three months, and from 20*l.* up to 100*l.* is the limit to be called for in one year; the minimum amount has been more generally acted on, and money borrowed in anticipation of calls. Notice of calls are to be advertized from 10 to 21 days previous, and the amount of each varies in different companies from 3*l.* 5*l.* 10*l.* 15*l.* to 20*l.* per share, but the executive have in this case also preferred the smaller amount. With respect to transfer of shares, it is provided in railway Acts to be done by deed, which is, to be registered in the books of the company, but no time is stipulated within which such registration must take place. This has been taken advantage of by the public, and the deed is completed between the vendor and purchaser, except as to the insertion of the purchaser's name, and bearing the stamp of the *ad valorem* duty, at the time it passes from hand to hand without the payment of any more duty until a purchaser thinks proper to register; then the transfer is taken to the office of the company, and his name inserted as the purchaser. This system is connived at by the companies, who, to give an assurance to a purchaser of the validity of a transaction, do not hesitate to give a memorandum, under the hand of the secretary, of a long bygone transfer, which, to all intents and purposes, answers fully as well as a recent actual transfer; although the companies prefer giving out a filled up transfer. A transfer with a good stamp is accepted without inquiry. The purchaser, on the receipt of the transfer, can hold it as long as he likes, the seller having no means of compelling registration; the seller is, therefore, liable to the calls after he has sold his interest in the company, and without any means of compulsion in his hands whereby he might regain his shares; again, provided he paid the call, the vendor may sell his share a second time, and the second purchaser, upon priority of registration, would be entitled to the share; he, the vendor, is at the same time liable for calls upon his share after its sale, so long as his name is retained on the company's books; also so long as his name is retained, his share is liable to be taken in execution for the debt of any individual creditor, or in the case of bankruptcy his creditors would claim it as part of the general estate, in preference to the title of the first purchaser. These are the legal difficulties that accrue from the use of the blank transfer (that is blank as regards the name of the purchaser) in addition to the loss to the revenue of the stamp duty on the increase of the share's value, and on each transaction subsequent; there is also the uncertainty and inconvenience to which the company are put in ascertaining the opinions of their proprietary.

The new registry of shares has also been turned to account by the executive of the Companies, so as to increase individual influence. It has been previously stated that no one person is to have more than from 10 to 60 votes, and that 20 shares are entitled to 20 votes, with an extra vote for every five shares in addition, but not to exceed, in all, 60, whatever the number of shares held may be. In a recent case, quoted in the *Railway Times*, an individual held 299 shares in a Company, and was registered for only 25, holding the remaining 274 shares in different names in lots of 20 each; by this means his number of votes was increased by 220 votes, in addition to 25 votes which he was entitled to by the act, which in question decided by vote

of proxy must be obviously "undue influence." Individual influence, and thereby patronage and favouritism is also increased by companies having the power of purchasing shares to merge in the company, which are held not in the company's name, but by directors in trust for the company. This is of immense importance in the appointment, or otherwise, of committees of inquiry into management of companies; one recently appointed was carried by a majority of 715 when nearly 8,000 votes were polled. The committee of inquiry reported; the directors replied; the committee answered, and the directors published a rejoinder, and another poll took place, the direction beating the committee by a majority considerably less than before; to gain which every move was tried, and thirty votes held in trust in names of directors were openly used and it was at the same time strongly contended that the right to vote was in the share, not the individual; he might be bankrupt, a convict, a felon, or even dead, and being known to be dead, he would be revivified for the day.

Sales or purchases of shares are generally made through a share broker, who uses the prefix "share" to distinguish him from other brokers; those of the Stock Exchange generally act as London agents for the provincial brokers, and sometimes the fees on commission are divided between them. For shares under five pounds the commission varies from a shilling, as the circumstances may differ. The following is the usual scale of brokers' commission:—

£.		
	1 0	per share.
5 under 20	2 6	
20 „ 50	5 0	
50	10 0	per cent. Debentures 5s. per cent.

The stamp duty payable on transfer of shares is the same as the *ad valorem* duties on assignment of lands.

In addition to the stamp duty, which is paid always by the purchaser, some of the companies make a charge of 1s. to 2s. 6d. for each transfer in the company's books, which is charged to the credit of the company, or allowed as a fee to the secretary as an augmentation of his salary. The charge for registration of a transfer which is adopted by some companies, as the Greenwich, Taff Vale, and Newcastle and Darlington Junction and South Eastern Railways, varying from one shilling to half-a-crown, tends also to further the continuance of the practice of using blank transfers and the consequent evasion of the duty, and I apprehend those who adopt the charge do not improve their undertaking in the estimation of the public.

I have omitted to notice that in many of the companies the fifth part of the shares in the first allotment are reserved for the landowners on the line; and that in the creation of new shares, old shareholders have priority, the shares being allotted in proportion to their holdings, and that some companies have been in the practice of paying interest, during the execution of the work, on capital or paid up shares, so soon as one-fourth of the share has been called. Among those who have so acted, that I can call to mind, are the Greenwich, Grand Junction, and Newcastle and Carlisle Companies.

As I said on the commencement of this paper that this subject was not my forte, or in my line, I cannot therefore enter on the zoology of the two animals "Bull and Bear," or the inexpediency of what are called time bargains to individuals on the Stock Exchange, and their detrimental effects to the undertaking in which the transactions are made, the directors having no control over the parties operating, who unnaturally depress the value of the shares, no matter what may be the depressed state of the market, these fine gentry are generally obliged to get out by hook or by crook, and at any sacrifice to themselves and the undertaking. The companies have also to a certain extent adopted the principle of time bargains both with respect to the issue of loan notes and debentures; of the latter mode of proceeding the Eastern Counties is an example, who give the holder of each debenture of 8l. 7s. 6d. the option in three years of taking a 25l. share of the former; the Croydon company give the option for the same period to the holder of loans, to convert 15l. loan notes into a share of 20l., and the Brighton for a similar period of three years to the holders of their loan notes of conversion into quarter shares at 10l. each.

A system of leasing the works of one company to another has been, to a certain extent adopted, which was done, I think, first, by the York North Midland taking the Leeds and Selby line for a term of years. The following have also followed the example: The Birmingham and Gloucester have a lease of a portion of the Cheltenham and Great Western Union from Cheltenham to Gloucester, and the Great Western have a lease of the Bristol and Exeter, and a portion of the Cheltenham and Great Western Union; the rent of the former being 30,000l. and the latter 17,000l. per annum. The South Western or Southampton Railway took up the Gosport Branch Railway, and paid the shareholders 5 per cent., with option after a certain time of joining in a general dividend with the main line, and a similar course has been pursued with the Warwick and Leamington Company, and the Birmingham Company. The system of letting or leasing railways to private individuals has been attempted on the Northern and Eastern and the Brandling Junction Railway; the committee of inquiry, on investigation, recommended that system in respect to their lines, but no case as yet has it been carried into practice.

To conclude this rambling paper I refer to the greatest difficulty that railway companies have to contend with, viz., the closing of capital account in consequence of disputed accounts with contractors, and the excess of capital required over previous estimates, rendering it almost impossible for the uninitiated to form any opinion as to the merits of an undertaking so situated, with reference to their solvency or otherwise, and the consequent uncertainty of railway stock as an investment for the widow or trustee, and all experience shows that until a railway is finished, and its traffic fully developed, the greatest uncertainty attaches to such works. I have endeavoured, however, imperfectly to point out the manner adopted by railway companies of raising capital by shares and loan, also the mode of transferring shares, the amount of share and the consequent liabilities, and the influence of holding, as to individuals and directorates in the management of railways and the power of control as to the shareholders at large. At the same time I have pointed out that little or no information is to be had in any work expressly devoted to railways, on this subject, they being more generally devoted to the description of the construction of the more important bridges, &c. on each railway, its course and direction, and the towns in the vicinity. I am nevertheless in hope that this paper will call attention to the subject by one more competent to the task.

One desideratum yet required to give stability to railway property is, the closing of capital account, and the publication of shareholders and the number of their holdings, and the full developement of passenger traffic as regards the third class carriages, which ought not to be so constructed, that 70 persons are made to stand up without cover or shelter; the principle on which the companies ought to act is, to carry people cheaper than they can walk, as notwithstanding the saving of time, another element in the calculation is money, which is said to be also time; but in the present depressed state, many have time to spare for travelling, but not money also, at least in quantity sufficient for pleasure, even at second class fares. As to goods traffic, I think that as regards general merchandize, that the old system will be able to compete with railways; and as regards coal or other produce, always conveyed in one direction, the local or large holder generally makes a bargain consonant with his own notions. Passengers are the main support of railways; and the safety to passengers is no speculative point, eighteen millions of persons having travelled by railway in 1842, and only one was killed whilst riding in a train; and there is no doubt that the traffic and returns have also exceeded the most sanguine expectations of the original projectors, as well as the amount of capital required. Railways must ultimately pay, and settle down into one of the most eligible of investments, as the facility with which a transfer can be made in comparison with a freehold, is greatly in their favour.

I have annexed to this paper the different forms of transfer, certificate for a share, and a scrip certificate also of a proxy, and the memorandum given by the secretaries that a share or shares on a given date were transferred from a certain name to another.

St. Ann's, Newcastle-upon-Tyne. O. T.

APPENDIX.

No. 1.—London and Paris Railway.

John Doe, of the town and county of Newcastle-upon-Tyne, agent, in consideration of £100., paid by the said Richard Roe, do hereby bargain, sell, assign, and transfer to the said Richard Roe, ten shares, numbered 3270, 3269, &c., of and in the undertaking called The London and Paris Railway. To hold to the said Richard Roe, his executors, administrators, and assigns, subject to the same rules, orders, and restrictions, and on the same conditions that the same were held immediately before the execution hereof. And the said Richard Roe does hereby agree to take and accept of the said shares, subject to the same rules, orders, and restrictions, and conditions. Witness our hands and seals this twelfth day of June, in the year of our Lord one thousand eight hundred and forty three.

Signed, sealed and delivered (being first duly stamped) by the said John Doe, in the presence of ———	John Doe.
Signed, sealed and delivered (being first duly stamped) by the said Richard Roe, in the presence of ———	Richard Roe.

No. 2.—The London and Paris Railway Company.

No. 14228.

These are to certify that John Doe is the proprietor of the share numbered 14228 of the London and Paris Railway Company, subject to the rules, regulations, and orders of the said company.

(Seal of company.) Given under the common seal of the said company, the twelfth day of June, in the year of our Lord one thousand eight hundred and forty three.
Registered No. 665.

Secretary.

On the back—
Transferred to Richard Roe and registered.

Secretary.

No. 3.—London and Paris Railway.

Scrip certificate. 10 shares.
No. 841. No. 841.

The holder of this certificate will be entitled to ten shares of £50. each, upon the performance of the several conditions relating to the second and subsequent instalments contained in the resolutions of a special General Meeting of the proprietors of this company, held on Thursday, the 28th of April, 1842, a copy of which is at the back hereof.

London and Paris Railway Office,
10, ——— Street, London,
May, 1843.

Entered—John Doe, Accountant.

Richard Roe, Secretary.

No. 4.

Memorandum.

London and Paris Railway Office,
No. 3271. 10, ——— Street, London,
6th day of Feb. 1840.

Ten shares in this company, No. 3261 to 3270, were this day transferred from Mr. Richard Roe to Mr. John Doe.

For John Noakes, sen., Secretary.
Thomas Styles.

No. 5.

Form of Proxy.

I, of one of the proprietors of the London and Paris Railway Company, do hereby appoint of to be my proxy, in my name and in my absence to vote or give any assent or dissent, to any business, matter, or thing, relating to the said company, that shall be mentioned or proposed at any meeting of the proprietors of the said company, in such manner as the said shall think proper, according to his opinion and judgement, for the benefit of the said company, or anything appertaining thereto.

In witness whereof I have hereunto set my hand the day of

A TRIP TO BOULOGNE AND BACK IN ONE DAY.

SOUTH-EASTERN RAILWAY.

Hitherto this railway has been open as far as Ashford only, but it is now completed up to Folkstone, to which point the public are now enabled to go. The company having purchased the harbour of Folkstone, one of their objects is to establish a steam communication direct from that port to Boulogne, in addition to that which, when the line is completed, will be effected from Dover to Calais. To demonstrate the ease with which this may be done, and at the same time to show the practicability of a trip from London to France and back in a day, an experimental journey was performed on Saturday the 24th ult, the result of which was perfectly satisfactory. At 6 o'clock a special train, containing the directors and their guests, started from the London-bridge station, which arrived at the Folkstone station, a distance of 81 miles from town, in two hours and 40 minutes, having stopped at five stations by the way, losing 10 minutes.

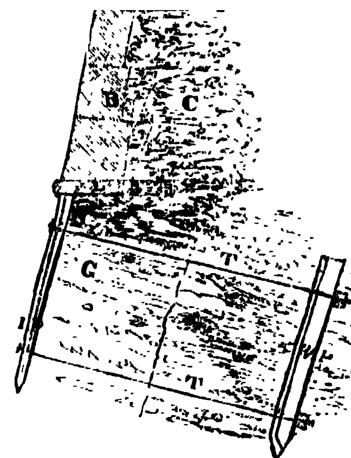
Mr. Wright, the resident engineer of the line from Folkestone to Dover, was in attendance on the arrival of the company, and conducted them to Folkestone harbour, when the "Water Witch" steamer was lying ready to receive them: the period of walking from the railway and embarking occupied 39 minutes. The vessel got under way at 40 minutes after 8 o'clock, and made the voyage across the channel in 3 hours and 6 minutes, and arrived at Boulogne at 25 minutes after 12; the company landed and presented to the mayor, who was in attendance to receive the company, with the *Times* of that morning, containing the debates in parliament of the previous night. After partaking of a splendid entertainment at Boulogne, and remaining at that place 2 hours and 13 minutes, the company returned on board the steamer, and landed again at Folkestone after a passage of 3 hours and 45 minutes, and with a loss of 45 minutes in landing, and walking again to the railway. The company left the station at Folkestone at 7 minutes after 7, and arrived at London-bridge at 6 minutes after 10, losing 15 minutes in 5 stoppages; thus, the whole journey to and fro, occupied 16 hours and 6 minutes; and deducting stoppages of 4 hours and 7 minutes, the time actually travelling was 12 hours within a minute. A saving in time of at least half-an-hour will be effected when the proposed branch is made to the harbour of Folkestone. With a fast-going steamer, the trip across might be perfomed upon an average, in about 2 hours-and-a-half, thus the journey direct from London-bridge to Boulogne, may be completed in 5 hours.

MISCELLANEA.

The Cartoon Exhibition, Westminster Hall.—We understand the designs sent in far exceed in merit the anticipation of the Commissioners, and those persons fully competent to judge. We are informed that they are to be opened for public exhibition, on Monday, July 3rd; during the first fortnight an admission of one shilling each person will be demanded, after that time it will be open free to the public, excepting on Saturdays, in the morning of that day it will be closed, and in the afternoon opened to the admission of those who will pay one shilling; the funds to be devoted for the promotion of the fine arts, as the commissioners may determine hereafter, according to the amount. We are sure that this arrangement will give the greatest satisfaction both to the competitors and the public.

Royal School of Design.—Professor Dyce has resigned the office of director, and has been elected on the council. He is succeeded as director by Mr. Wilson, of Edinburgh, some of whose communications on art have appeared in our columns, and are sufficient to show that intimate knowledge and appreciation of art which Mr. Wilson possesses. A better appointment could scarcely be made.

Greenwich Pier.—We abstained last month from giving any account of the failure of this pier, which took place on 16th of May last, as we had not then an opportunity of personally inspecting it, or of ascertaining its construction; we have since been favoured by our valuable correspondent, O. F. with the following observations, and sketch of the pier. He observes, "The failure of Greenwich pier is not a matter of surprise to parties who understand the practical construction of such works. The immediate cause of the failure was dredging in front of the piles after the contractors had left the works, and the arrangement of the piles being faulty, as regards construction; the upper part is composed of brickwork in cement (B), 18 feet high, and 14 inches thick at top, capped with granite 1 foot thick, backed with concrete (C), and standing upon a foundation of Yorkshire stone landings (L), laid on a small quantity of concrete, with a substratum of foul gravel (G). The landing in front rests on a row of cast iron piles (I. P.) 25 feet long and 5 feet apart, grooved to admit between them three cast iron plates, each 6 feet in height, these iron piles were fastened by four, or two pair of wrought iron land ties (T) 2 inches square, to wooden piles (W. P.) 18 feet long, and 12 inches square, driven in land at a distance of 25½ ft. from the front, and 5 ft. apart." The high water mark is about 4 feet from the top, and low water mark 22 feet below, or about 7 feet below the stone landing. From enquiry, we rather suspect the lower ties, as shown in the sketch, were not fixed, nor do we see how they could be, as they are shown considerably below low water mark. The superincumbent weight of the brickwork appears to have forced out the upper part of the iron piles to a considerable distance, and caused the brickwork above to slip down, and force out the iron plate; but, it is very difficult to say, whether this is the real cause of the failure, for until the ruins are cleared away, nothing positive can be stated.



Sunderland.—Several fissures are said to be apparent in the celebrated Victoria Bridge, over the Weir. The Sunderland Harbour Commission have abandoned the plan of Mr. Murray, for converting the harbour into a dock, but they have another plan of improvement which is not yet public.

Newcastle.—The new church of St. Peter has been opened, Mr. John Dobson, Architect, and a Catholic cathedral, by Mr. Pugin, is now being roofed in, the style is early English; stone is used throughout in both these edifices, the tower has been left unfinished until further funds are obtained. Messrs. Green are architects for Lord Durham's monument, which is to be a Grecian Doric temple, and built on Panister Hill.

Warkworth Harbour.—The works are again commenced by the company, the contractor having made arrangements to surrender the works to the company.

Newcastle and North Shields Railway Company are excavating a cutting 50 feet deep for a road from the Station to the New Quay, with retaining walls, and a bridge to carry a road over it at a cost of about 7,000*l*,

Birmingham and Derby Railway.—No arrangement is likely to be made in respect to the unfortunate differences with the Midland Counties Railway, upon terms fair to the shareholders of either company.

Midland Counties Railway.—The Weir across the Trent, at the Soar Mouth, is being constructed, not of Ashler stone, but of timber piles and waling, and supported with inclines of Rubble stone above and below. The Weir of ashler has been rescinded by a late Act, on condition of the railway company maintaining it for ever; its cost is about 5,000*l*. The Trent company insist upon its being done this summer, in consequence of several boats having been sunk by coming in contact with Trent Bridge.

Hertford and Ware Railway.—The works are taken by Grissell and Peto, who have also taken extensive improvements of the Severn, in Gloucestershire, to the amount of 129,000*l*.

NOTTINGHAM AND DERBY CANAL.—The tonnage on this canal has much fallen off during last year. The Yorkshire route of rails taking the Hull, and some of the Boston and Lincoln goods over their lines to Manchester, and even grain and timber to Derby.

MORPETH.—A new church is to be built, and the Rev. Mr. Grey, a relative of Earl Grey, has subscribed 1,000*l.*, and nearly another thousand was lately subscribed.

NOTTINGHAM.—St. Mary's church, tower unsafe, secured temporarily by Mr. Cottingham, architect, and Hawksley, architect, has been called in by the corporation; the columns are split vertically which support the tower, and temporary trussing is used to support them.

ATHENS, May 12.—A statue larger than life, and executed in the Egyptian style, has been found near Marathon, and is just brought to our museum. The figure has an iron disc in each hand. Some assert that it is a representation of Antinous: others consider it an Apollo.

THE SPEAKING MACHINE.—I have as yet seen no notice in your valuable periodical of an invention, which is, at present, attracting great attention here, and which certainly merits every praise that can be bestowed upon unwearied perseverance and successful ingenuity. It is the *Sprachmaschine* or the Speaking Machine, not quite appropriately called Euphonia, of M. Faber, the result of a beautiful adaptation of mechanics to the laws of acoustics. You are aware that the attempts of Cagniard la Tour, Biot, Muller, Steinle, to produce articulate sounds, or even to imitate the human voice, have not been very successful; in fact, our knowledge of the physiology of the larynx and its appendices has been so limited, that we have not even an explanation of the mode in which the falsetto is produced. Mr. Faber's instrument solves the difficulties. I can only give you a very imperfect idea of the instrument. To understand the mechanism perfectly, it would be necessary to take it to pieces, and the dissection naturally is not shown the visitor—less from a wish to conceal anything, than from the time and labour necessary for such a purpose. The machine consists of a pair of bellows at present only worked by a pedal similar to that of an organ, of a caoutchouc imitation of the larynx, tongue, nostrils, and of a set of keys by which the springs are brought into action. [The further description would be unintelligible without diagrams.] The rapidity of utterance depends of course upon the rapidity with which the keys are played, and though my own attempts to make the instrument speak sounded rather ludicrous, M. Faber was most successful. There is no doubt that the machine may be much improved, and more especially that the *timbre* of the voice may be agreeably modified. The weather naturally affects the tension of the Indian rubber, and although M. Faber can raise the voice or depress it, and can lay a stress upon a particular syllable or a word, still one cannot avoid feeling that there is room for improvement. This is even more evident when the instrument is made to sing, but when we remember what difficulty many people have to regulate their own chordæ vocales, it is not surprising that M. Faber has not yet succeeded in giving us an instrumental Catalani or Lablache. Faber is a native of Freiburg, in the Grand Duchy of Baden—he was formerly attached to the Observatory at Vienna, but owing to an affection of the eyes, was obliged to retire upon a small pension; he then devoted himself to the study of anatomy, and now offers the results of his investigations and their application to mechanics, to the world of science.—(*A Correspondent of the Athenæum*)

Hamburgh, March 31. S.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM MAY 30, TO JUNE 21, 1843.

Six Months allowed for Enrolment, unless otherwise expressed.

William Newton, of Chancery-lane, civil engineer, for "*improvements in obtaining copper from copper ores, some part or parts of which improvements are applicable to obtaining certain other metals contained in some copper ores.*" (A communication.)—Sealed May 30.

William Edward Newton, of Chancery-lane, C.E., for "*improvements in the method or system of constructing boats and other vessels, which the inventor intends to denominate the "Mondotian system.*" (A communication.)—May 30.

John Tappan, of Fitzroy-square, Middlesex, gent., for "*improvements in apparatus applicable to flues or chimneys, for the purpose of increasing the draft therein, and promoting the combustion of fuel.* (A communication."—May 30.

Thomas Forsyth, of Salford, Lancaster, engineer, for "*improvements in machinery for making bricks and tiles.*"—June 1.

Pierre Frederick Ingold, of Buckingham-place, Hanover-square, watchmaker, for "*improvements in machinery for making parts of watches and other time-keepers.*"—June 1.

Henay Fox Talbot, of Locock Abbey, Wilts, Esq., for "*improvements in photograpy.*"—June 1.

Martyn Roberts, of Carmarthen, Esq., for "*improvements in machinery for preparing, spinning, and winding wool, cotton, flax, silk, or any other fibrous bodies.*"—June 1.

Fennell Allman, of Salisbury-street, Strand, surveyor, for "*improvements in apparatus for the production and diffusion of light.*"—June 3.

Junius Smith, of Fen-court, Fenchurch-street, London, gentleman, for "*improvements in machinery for sawing wood.*"—June 3.

Brown, of Glasgow, merchant, for "*improvements in the manufacture of porcelain china, pottery, and earthenware, and which improvements are also in part applicable to the manufacture of paper, and to the preparation of certain pigments or painters' colours.*"—June 3.

Richard Farmer, upholder and cabinet-maker, and Joseph Pitt, plumber's brass-founder, both of Birmingham, for "*improvements applicable to fixed and portable water-closets, and beds or bedsteads, a part or parts of which improvements are also applicable to raising and forcing water.*"—June 6.

Robert Smart, of the Commercial-road, Redcliff, Bristol, ship-owner, for "*improvements in paddle-wheels.*"—June 8.

John Burns Smith, of Salford, Lancaster, cotton spinner, for "*improvements in machinery for preparing, carding, roving, and spinning cotton, and other fibrous substances.*"—June 8.

Cartaret Priaulx Dobree, of Putney, Surrey, civil engineer, for "*improvements in the manufacture of fuel.*"—June 10.

Henry Page, of Cambridge, painter, for "*improvements in the mode of painting, graining, or decorating with oil, and other colours.*"—June 10.

Henry Austin, of 87, Hatton-garden, civil engineer, for "*a new method of gluing or cementing certain materials for building, and other purposes.*"—June 10.

Edward Joseph Francois Duclos de Boussois, of Clyne Wood Works, near Swansea, engineer, for "*improvements in the manufacture of lead, tin, tungsten, copper, and zinc, from ores and slags, and other products, and in the manufacture of their alloys with other metals.*"—June 10.

Ernst Leutz, of Eastcheap, gentleman, for "*improvements in machinery for raising and forcing water and other fluids, which machinery, when worked by steam or water, may be employed for driving machinery.*" (A communication.)—June 10.

Alfred Francis, of Vauxhall, Surrey, Roman cement manufacturer, and Isaac Funge, workman in the employ of the said Alred Francis, for "*improvements in the manufacture of ornamental tiles.*"—June 10.

Samuel John Knight, of Water-side Iron Works, Maidstone, Kent, founder, for "*improvements in kilns or apparatus for drying hops, malt, and other substances.*"—June 10.

Thomas Wells Ingram, of Birmingham, engineer, for "*improvements in pressing and embossing wood, and other materials, in order to apply the same to various useful purposes.*"—June 10.

Samuel Sparkes, of Wellington, Somerset, foreman at a woollen manufactory, for "*certain improvements in machinery for carding wool, cotton, and other fibrous materials.*"—June 10.

John Tappan, of Fitzroy Square, gentleman, for "*certain improvements in apparatus for grinding and polishing cutlery, and other articles, whereby the deleterious effects on the lungs and health of the workmen, produced by the dust and metallic particles arising from the said operations are entirely, or to a great extent obviated.*"—June 10.

William Edward Newton, of Chancery-lane, civil engineer, for "*the novel application of certain volatile liquids for the production of light, and improvements in the lamps and burners to be employed for the combustion of such or other volatile liquids.*"—(A communication.) June 10.

John Galley Hartley, of Narrow-street, Limehouse, mast and block maker, for "*certain improvements in paving and covering streets, roads, or other ways.*"—June 13.

Frederick William Eggleston, of Derby, confectioner, for "*certain improvements in the combustion of fuel and consumption of smoke.*"—June 15.

Henry Bessemer, of Baxter House, Saint Pancras, engineer, for "*certain improvements in the manufacture of bronze, and other metallic powder.*"—June 15.

Prosper Antoine Payerne, of Paris, doctor of medicine, for "*certain improvements in keeping the air in mines and other confined places in a pure and respirable state.*"—June 15.

Thomas Johnson Irvine, of Peckham, lieutenant in Her Majesty's navy, for "*certain improvements in packing cases, boxes, trunks, portmanteaus, and other articles for containing goods, which improvements may, under certain circumstances, be applied to the preservation of life.*"—June 15.

George Lister, of Dursley, Gloucester, card-manufacturer, and Edward Budding, of the same place, machinist, for "*certain improvements in the means of covering the cylinders of carding and scribbling engines with wire card, and in condensing the rovings delivered from such engines, and also an apparatus for sharpening or grinding the points of the cards, which latter apparatus may also be employed for grinding other articles.*"—June 15.

Edward Hammond Bentall, of Heybridge, Essex, iron founder, for "*certain improvements in ploughs, and in apparatus which may be attached thereto, for ascertaining the draft of instruments employed in tilling land.*"—June 15.

George Bate, of Bloomsbury, Wolverhampton, Stafford, carpenter, for "*improvements in apparatus for raising and lowering window blinds and maps.*" June 15.

James Gardner, of Banbury, Oxford, ironmonger, for "*improvements in cutting hay, straw, and other vegetable matters for the food of animals.*"—June 15.

Samuel Brown, of Gravel-lane, Southwark, engineer, for "*improvements in the manufacture of casks and other vessels.*"—June 17.

James Mackenzie Bloxand, of Hampstead, esquire, for "*improvements on meridian instruments.*"—June 20.

John Read, of Regent-street, machinist, for "*certain improvements in ploughs for draining, subsoiling, and cultivating land.*"—June 21.

SOME OBSERVATIONS ON PROPRIETY OF STYLE, PARTICULARLY WITH REFERENCE TO THE MODERN ADAPTATION OF GOTHIC ARCHITECTURE.

By Edward Hall, Architect.

(Read at the Royal Institute of British Architects, June 26th, 1843.)

" dead men
" Hang their mute thoughts on the mute walls around."

" Yet to the remnants of thy splendour past,
" Shall pilgrims pensive, but unwearied, throng."

Very few years have elapsed since the style of architecture, called Gothic, was ill-appreciated, or little understood in England. Teeming as our island is in its highways, and its sequested nooks, with mementoes of the piety of past generations—discoursing "sermons in stones" —and breathing, through the interval of centuries, on the chords of present time—the lyre lay long untuned, and gave none but discordant notes. The labours of the honoured few, who alone cherished a love for the architecture of the country, were treated with ridicule and contempt; whilst the student and the man of letters, slighting, or ignorant of what his country contained, sought in Italy, and in Greece, vestiges of the arts and mythology of nations, whose religion was idolatrous, and whose architecture ill consorted with the requirements of a Christian faith. Our cathedrals were repaired with a degree of carelessness, pardonable at no time; and were crowded with screens, and altar-pieces, and with costly monuments, discordant in style as they were tasteless in design and execution. But, happily for the honour of the age, love of antiquarian topics, and of works of art for their intrinsic excellence, have caused a re-birth in architectural history. The wonderful skill in construction, and the taste of our ancestors are appreciated; the remote village church is examined for the beauties which characterize *it*, not less than do fine proportion and elaborate enrichment the *cathedral* and the *college*;—religious feeling assists in the movement, and it is scarcely too much to say, that the time is close at hand, when, for ecclesiastical structures, [1] Gothic architecture will become as much the architecture of the country as during the splendour of the thirteenth and fourteenth centuries.

However, as architects, we may regret the tendency at our universities towards imitation rather than design, it must be allowed, that the attention, paid to Gothic architecture there, has met with good results, in a greater care in the restorations of existing fabrics. The importance, as historical records, which attaches to all architectural remains, renders it a sacred duty in the architect to well inform himself on all features in different styles, so as to transmit to posterity the structures he is called upon to re-instate, with every line and trace of their founders' character and skill. The architecture of Egypt in its paintings and hieroglyphics, in its long and gloomy vistas, and its avenues of sphinxes, is a lasting petrifaction of the manners and customs of the people, and of the dominion of that mysterious hierarchy, who sat in judgment over the dead, and who curbed the flights of imagination in architecture and in sculpture by inviolable regulations. The porticos and sculptures of Greece are living evidences of the refinement of a nation, who responded to the works of its artists, as to the creations of the dramatist, and the reasoning of the philosopher; while the sumptuous edifices of the Romans speak of the pomp of imperial sway and the slavery of subject states. The architecture of every country, and of every age, is vocal with the inmost workings of its creating mind: and it occupies the place of written history in points which, though of the highest interest, historians have for the most part failed to touch. The architecture of the middle ages is not less valuable to the observing student of history, than the architecture of Egypt, of Greece, or of Rome. To the eyes of the general historian and the artist, the majesty and richness of the cathedral tell of the self-sacrificing spirit of our forefathers, who devoted their wealth and their lives to the service of religion. Every village church is a key to the history of the surrounding district;—from its effigies, its sepulchral brasses, and its heraldic enrichments, the topographer and the genealogist may derive important data, for the prosecution of researches into the history of a county, and of its principal inhabitants. The "very age and body of the time" are manifest in each feature, and in the minute details are related even the passions, and the animosities of the different orders of the priesthood. Though sad instances of destruction still occur, though churches still receive their periodical coat of whitewash—until the richest foliage is obscured by the useless repetition [2]—the course of demolition has been reduced; while the restorations in progress, or about to commence, afford matter for the highest gratulation. Thus the architect must combine the pursuits of the antiquary with the study of the practical and the recent; his researches must extend into the curious and the obsolete, to enable him to understand the style and details of any edifice under his care.

It is a matter of surprise to all who study and love the architecture of the country, that its revival for ecclesiastical structures should have met with opposition. This opposition — urged by the highest love of art—has been publicly expressed and published, so that it seemed incumbent on those who desired to walk in the steps of our forefathers, to show that another view of the question was not unsupported by argument. But the matter not having received the notice that might have been expected, I have ventured before you this evening, and if the question suffer in my hands, I beg it may be understood, that arguments are *not* wanting which could have been adduced by those, who might have anticipated me in my present subject.

The opinions referred to may be thus stated. That the "taste of the day inclines to the Roman Catholic plan, suited to a demonstrative form of worship, rather than to the auditorium required by the Protestant ritual," and that "the churches of Sir Christopher Wren are better adapted for models." That proportions in Gothic architecture were "wholly capricious," and "subject to no order or regularity," nor that "any have been ever attributed" to the style by its greatest admirers, so that "columns or supports might be from five to fifty diameters in height, and were only bounded by possibility;" that the delight, confessedly inspired by the works of the middle ages, is to be referred to a "love of the marvellous," which "love of the marvellous is dangerous, exaggeration being the first sign of a mind indifferent to the value and beauty and sufficiency of truth, and the surest sign of depravation of judgment." "The Egyptian, the Roman, and sometimes the Greek indulged in the gigantic, with a view to the expression of a prodigious energy; but the middle ages were prone to the marvellous, surprise was the great scope of the Gothic architect." That "the middle age church was wholly founded on superstitious associations." "The plan described the cross, the universal symbol *in hoc signo vince*." That "the nave represents the body of the saviour; and the side, which 'one of the soldiers pierced,' considered to be the south as the region of the heart, is occupied at Wells by a chantry, at Winchester with the chapel of William of Wyckham, and is constantly the pulpit from which the faithful were reminded 'to look on him whom they have pierced.'" "The choir was inclined to the south, to signify, that 'he bowed his head and gave up the ghost,'" and "there are few cathedrals in which this deflection is not remarkable." "At the head of the cross was the chapel of the Virgin—Jesus resting in the lap of Mary. At the foot, the west-end, was the 'Parvis,' supposed by some to be a corruption of 'Paradis,' that happy station from which the devout might contemplate the glory of the fabric, which was chiefly illustrated in this front, and from whence they might scan the great sculptured picture, the calender for unlearned men, as illustrative of Christian doctrine and the temporal history of the church, under its princes and its pre-

[1] It will be observed, that the subject of propriety of style in domestic architecture is not now entered into.

[2] The whitewashing, colouring and painting of *stone* are species of *monomania* frightfully prevalent. The base of the internal order of St. Paul's Cathedral seems to have been painted not long since, and, being of a bright yellow, contrasts with the older whitewash above. It may be assumed that this is not in accordance with the wish of the present talented architect. Colouring for the purposes of decoration, which requires no renewal, is mostly on flat surfaces, and can spoil no ornaments or mouldings; is unobjectionable, and a valuable means of enrichment.

lates. Three great niches leading into the church, the centre one above forty feet wide, were adorned with the statues of the apostles and holy men, who 'marshal us the way we should go;' in front, the genealogy of Christ, the final judgment, the history of the Patriarchs &c." Further it is said, that "the same want of cultivated judgment, which is apparent in the æsthetical of the arts of the middle ages, is traced also in the imperfection of their statics and stereotomy, in which again solidity is sacrificed to superstition." That as "the figure of the cross" was "indispensable," though "the arches of the nave, formed their abutment abundantly in the western termination, which was commonly fortified by prominent buttresses, no such abutment existed at their eastern termination towards the lofty pillars of the transept." Consequently, that "the smallest failure of foundation or superstructure, threw so much weight against these pillars as to occasion them to bend," and therefore, the weighting of the pillars with a tower or spire being insufficient, "the last disfiguring remedy, the construction of a reversed arch between them, was employed," (vide section of Wells Cathedral.) Further, that we "crudely adopt the niched and canopied architecture of a religion, peopled with images of saints and martyrs, sibyls, angels and holy men, to a Protestant religion, which, admitting none of these, must leave the niches and the canopies *tenantless*, like well-gilt frames adorning an apartment, the pictures being omitted;—the pride and pomp of heraldry, armorial shields and crests, to an age in which chivalry is exploded and quarterings have dwindled to insignificance." That "slighting those excellencies of sculpture, which shed such lustre on the palmy days of Italian art, we oblige our artists to 'copy the obscenities and senseless carvings of barbarous times, simply that we may carry out the imitation of a style in all respects;'" and, finally, that the result of our want of unanimity in style will be the imposition of anachronisms on posterity, and the falsification of the pages of history in its most interesting and characteristic traits.—Any public expression of opinion is liable to opposition, and I may venture to dissent from these views, which I do for the following reasons.—Because the whole character and purpose of Gothic architecture is eminently expressive of the aspirations of a Christian faith. The upward tendency of the lines, and the pyramidal outline of the whole structure, culminating in the spire, draws the mind of the beholder from realities of earth to hopes of heaven. So inherent is the perception of this moral beauty, that a veneration for the forms of Gothic architecture, and a feeling of its propriety for Christian churches, has never been extinct. Contemned by some, as the offspring of a dark and superstitious age—though the same objection would equally obtain against the invention of printing, and that of the compass—surrounded with the enrichments of a foreign style, it *still* appeared in those traditional features to which the affections of the nation fondly clung. The inclosure of the altar by a screen or railing, answering to the rood-screen, is found, along with the oblong plan, and other features of the national architecture, even in the churches of Sir Christopher Wren, while, amidst all the contrivances and adaptations of diminishing arcades, and peristyles, and of obelisks, the form of the spire and pinnacle was preserved. The metropolitan cathedral was constructed on the old model of the cross with ailes, central and western towers. The style of architecture, changed in domestic buildings, was, in its most essential features, unchanged in sacred edifices, whilst the enmity it did receive from the literati of the towns, lessened not its hold upon the people of the country. The early churches, erected at a time when land had not attained its present extraordinary value, had sufficient space allotted them to afford room for interments, and to allow of the position and form which tradition had consecrated. The churches of the city of London, for the most part enclosed on every side, can scarcely be given as examples of the particular form of plan, most likely to have been adopted, had no trammels presented themselves to their builders. Yet in all of them there has been a recollection of the oblong form, suited to the earlier worship; whilst in a very large number the proportion of length to breadth is equal to that of Gothic churches. In *some* of them the foundations of the previous church were retained; but it is scarcely likely such "economy" would have been practised in that age to the presumed disadvantage of the church in other respects.[1] In the smaller Gothic churches, (*vide* Fig. 1.) the whole length of the nave and chancel is frequently but twice the width of the nave and ailes, so that that part westward of the rood-screen, and in, or immediately adjoining which, all portions of the service, demanding the arrangement of an auditorium, are performed, is of the dimensions retained in those churches of Sir Christopher Wren, which approach nearest to the square form.

Fig. 1.—Plan of Haddenham Church, Bucks.

That fine effect of length in the nave of the Gothic cathedral, like all beautiful effects in art, is due to an impression, produced upon the mind by skilful proportion and arrangement, rather than to actual dimensions upon the ground plan. The length of the nave is little more than double the breadth of the nave and ailes; while it does not amount to that in some of the finest cathedrals.—So that any opinion that a form, presumed to be better adapted for sight and hearing, was employed, to the exclusion of the established proportions, is scarcely borne out by a careful comparison of different fabrics. The nave of the earlier church will be found better adapted for hearing, than any of those churches which have not borrowed from the Catholic model; whilst the improvements in the internal arrangement of churches now in progress, by altering the size and position of the pulpit, and substituting open benches for pews, will render even an increased length of chancel less objectionable than the old arrangement, in which the cumbrous pulpit and reading-pew prevented all view of the communion. If an auditorium were all that is required for the purposes of religion, the ordinary lecture theatre would present the best form, but one which would excite no emotions of devotion. Were you to transplant one out of the major part of our metropolitan churches to some district "remote from towns," the chances are, that the structure would be called a villa or something else; but if you were to select Bow Church or St. Bride's, there would probably be some suspicion, that you had intended to erect a church. The truly appropriate character seems to reside in that style, which our forefathers adopted, and which is eminently expressive of every Christian's faith.

Since the close of the seventeenth century, when one, possessing the varied endowments of Wren, could style Gothic edifices, "moun-

	Ft.	In.		Ft.	In.
[1] All Hallow's, Bread Street	72	0	×	35	0
St. Mary, Aldermanbury	72	0	×	45	0
St. Michael, Cornhill	87	0	×	60	0
St. Mary's Somerset, Thames Street	83	0	×	36	0
All-Hallow's the Great, Thames Street	87	0	×	60	0
St. Andrew, Holborn	105	0	×	63	0
St. Michael, Queenhithe	71	0	×	40	0
St. Bride, Fleet Street	99	0	×	58	0
St. Benet's, Gracechurch Street	60	0	×	30	0
St. Mary, Aldermary	100	0	×	63	0
St. Matthew's, Friday Street	60	0	×	33	0
St. Stephen's, Wallbrook	82	6	×	59	6
St. Edmund the King, Lombard Street	60	0	×	39	0
St. Olave, Jewry	78	0	×	34	0
St. Magnus, London Bridge	90	0	×	59	0
St. Mildred, Bread Street	62	0	×	36	0

These dimensions are taken from various works of standing—but some vary a few inches from the actual measurement; they are, however, sufficiently near for the present purpose.

tains of stone, vast gigantic buildings, but not worthy the name of architecture," or Evelyn could say "Gothic architecture is a congestion of heavy, dark, melancholy, monkish piles"—vague and inappropriate expressions, bearing as little assimilation to the style as did the attempts of the architect to the churches he reviled:—since the time when Gough and Carter, and other honoured few, alone upheld the merits of our antiquities, how much has the study of our national edifices increased; and from this study, wonderfully systematised within late years, has resulted a high admiration of the old English architects, and of the principles which guided them in their sublime conceptions. Yet, the opinions of the seventeenth and eighteenth centuries have been revived in the nineteenth, and Gothic architecture treated as devoid of sound principles of proportion and taste. Though no Vitruvius of the middle ages has bequeathed to posterity written rules, and though heights and projections be not governed by modules, the opinion has been gradually growing, and has now reached conviction, that principles of design did exist, and that proportions of parts were observed. In the main principles of design, all styles, having claims to rank as beautiful, agree; and in *those* principles the medieval architects were consummate masters. In any style of architecture, whose horizontal and vertical lines are of equal number and prominence, we should not expect to find that beautiful effect, which results from an increased importance being given in one of those positions. Thus, while in the Grecian temple the main lines are horizontal, in the Gothic they are vertical; a like principle being observed in each. So when, during the decline of Gothic architecture, the horizontal line came into increased use, all the richness of ornament—so profusely lavished upon the structures of that age—failed to conceal the original mistake. In attention to pyramidal outline, whether of masses or of parts, the Gothic architects surpassed all rivals. In "unity and sub-division of parts," the groined vaultings and the window tracery of the best period, exemplify those main principles of beauty, which govern the disposition of the members in the Greek entablature—the beams and coffers in Italian ceilings—the cartoons of Raphael, and all beautiful compositions of whatever style and date. The west window of York Cathedral,

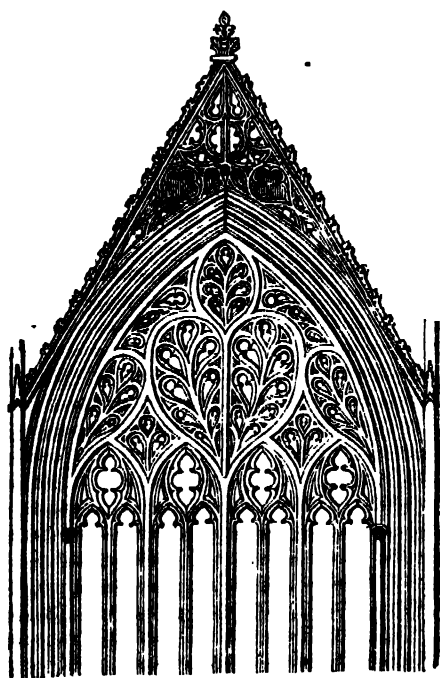


Fig. 2.—West Window of York Cathedral.

(Fig. 2,) will exemplify this. In this fine composition, no effect is improperly lessened by the presence of any neighbouring part. An arch of unornamented but elegant mouldings, placed beneath a rich crocketed canopy, circumscribes tracery of the most elaborate designs. Three mullions, each 11 inches in width and 8 inches in projection, divide the opening into four equal parts; each of these compartments is subdivided by another mullion, which is only 8 inches wide and 6 inches in projection. The ramifications of the head are marked out into large and bold features by the continuation of the larger mullion, from the sides of which spring the mouldings, which form the smaller ramifications. Drawing attention to so celebrated an example, with which all present must be quite familiar, affords me a main link in the chain of argument—indeed proves that the main unvarying laws of composition were known to the Gothic architects as to the great in art of every time.—

> " 'Mid curves that vary in perpetual twine,
> " Truth owns but one direct and perfect line."

This principle of dividing by large features, and subdividing by smaller, being—to use the words of Burke—"as it were, moulded into each other"—has been ably elucidated by Professor Willis in an elaborate paper on Gothic vaultings, published in the transactions of this Institute. It may be difficult to deny, that the principles of pointed design permitted a greater latitude, or, that exceptions to the general arrangement were not unfrequent in a style of such invention and variety; and it is also probable, that in the different lodges of Freemasons, the principles themselves might slightly vary; but to assert, by implication, that the beautiful creations of Gothic architecture are the results of accident rather than design, seems akin (if the comparison can be drawn without offence) to the belief of one, who, in the order and regularity of the universe, can discover no sign of a pervading Mind. The fact that the knowledge of the Freemasons was jealously guarded, is sufficient to account for our not possessing a written explanation of their secrets. Whilst, in one edifice, the proportions are to some extent deficient in elegance, in another we are delighted with their exquisite effect; which shows that they are still matter for study and attention, though they may not square with those of an opposite style. Take the example of an early English doorway of good character: we shall find that the perpendicular lines could not be lengthened or diminished without destroying the effect which its present proportions produce, unless we at the same time make some change in the decorative features. Thus, in the drawing of the doorway, Fig. 3, from Rothwell Church, Northamptonshire,

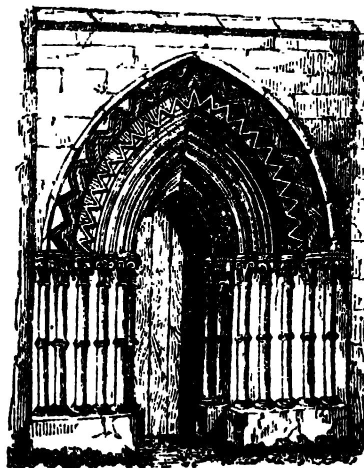


Fig. 3.—Doorway from Rothwell Church.

the opening is much narrower in proportion to its height than we generally find it in other doorways of the same date; but the effect of the *whole composition* is not lessened, for the increased width is gained

by the columns and decorations, and in appearance, by the horizontal line which runs across the composition in the shape of bands to the shafts. Yet, it seems to have escaped the attention of many detractors from the merits of pointed architecture, that it is possible, under different circumstances, to attain the same end by different means. As in Italian design—an arched doorway of two squares and a half in height, Fig. 4, would probably appear too lofty, if decocorated with a simple architrave, but, if a cone with panels be inserted, Fig. 5, the eye is at once reconciled to the proportion. Mr. Hawkins, in his "History of the origin and establishment of Gothic architecture," says that in the year 1321, several persons (whose names he gives) who were appointed to examine the works at Sienna Cathedral, declared that the works ought not to be proceeded with, as the established proportions of the old church would be destroyed, and it would not have that measure in length, breadth and height, which the rules for proportioning a church require. Had there been no settled rules of proportion, it is clear, that the architect could not have transgressed.

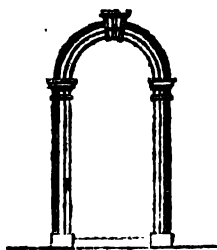


Fig. 4.

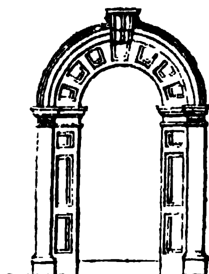


Fig. 5.

But the elucidation of a system, which might have been employed by the old architects, in proportioning the parts of buildings, has been attempted by Mr. Billings, and, as regards Carlisle and Worcester Cathedrals, with success. The same subject has also occupied the attention of the Oxford antiquaries. I am also disposed to give a higher rank than that of superstition to the system of proportion in which triangles were employed, first noticed by Cesare Cesariano, Fig. 6,[4] and illustrated by D'Agincourt, in his elaborate work, entitled "*Histoire de l'Art par les Monumens*," in the sections of Milan and Bologna Cathedrals. The objections brought against this system appear to have resulted from an inaccuracy in the description and diagrams of Cesariano. In Fig. 6 the triangles are all *equilateral*, and their lines intersect parts of the building in such a manner as to lead to the belief, that *they* actually determined the proportion; thus symbolic of the Trinity. But it may be asked, whether any cathedral constructed on sound principles might not have the same proportions, as to width of nave and ailes, as the one under notice, and if so, whether the use of equilateral triangles might not give the most effective arrangement. But, omitting this view, the opinions as to the "superstitious" origin of Gothic proportions, are founded, not on careful measurements, but on the obscure text and rough diagrams of Cesariano, which vary so much from the actual dimensions, as to give the total height of the spire one third less, than as at present existing. The triangle is of the greatest service in proportioning the parts of buildings, in accordance with that pyramidal character which should pervade every building of whatever style, and seems to have been so used by the Gothic architects. In a late work by Mr. Bartholomew it is shown that the pyramid or triangle may have governed the proportions of the west front of St. Paul's Cathedral;[5] and a similar method was probably practised by the earlier companions of the order, to which Wren belonged. Its application to the west front of York Cathedral I have endeavoured to show in the diagram, Fig. 7. That peculiarity of symbolising the different parts of buildings, though proved to have obtained amongst the Catholic priesthood, may not have *originated* either the proportioning by triangles or the disposition of the several parts. The after symbolising of various parts invested them with a peculiar sanctity; but that, in the *first* instance it governed the entire disposition, or that it ever tended to *lessen* the beautiful effect, I think yet demands further proof. At least, it should be shown, that this imputed symbolism stood in the way of a better arrangement, ere the Catholic architects are condemned for even the smallest attention to it. Indeed, a symbolic meaning, so to speak, might be discovered in buildings, in which it is clear no such intention ever existed. In St. Paul's Cathedral, the three large doors might be thought to symbolise the Trinity, and the four arms of the cross with its eight ailes, the twelve Apostles. Whether any symbolic meaning might be discovered in the three porticos of the Post Office, and of the National Gallery, or in

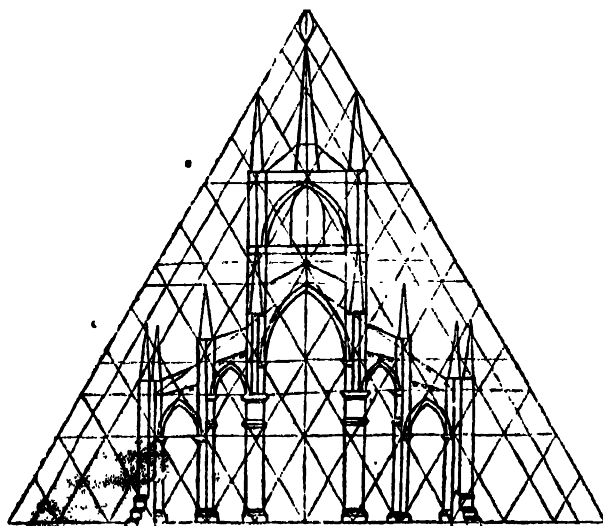


Fig. 6.—Cathedral of Milan—Cesariano's Theory.

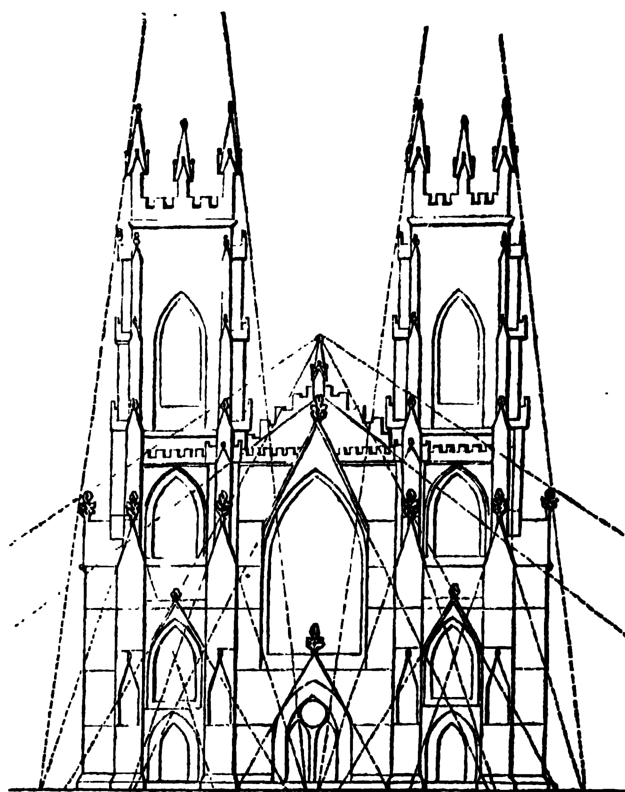


Fig. 7.—West Elevation of York Cathedral.

[4] The translation of Vitruvius by Cesariano is a scarce work;—the illustration given is from Hawkins' Gothic Architecture.

[5] "Specifications of Practical Architecture," vide *Journal*, Vol. III., p. 329.

the common street elevation of a door and window on each side, it is perhaps not safe to say; but the mere facility with such coincidences may be made to appear in all buildings, and in particular the constant and necessary combination of *three* objects, shows the necessity of extreme caution in speculating upon the subject. A writer in the *Gentleman's Magazine* well remarks, that those parts to which symbolism has been most commonly applied, are deficient in the most essential requisites, as the three divisions of the nave, and of the triple lancet, are in co-equality. That, so great a variety of rules, have been at different times, given for proportioning the parts of edifices, all nevertheless agreeing in the results, goes to prove that the particular system to be adopted is of less importance, than the use of some SYSTEM, from which may result that veiled grace, always delighting the mental vision in a structure projected by symmetrical rules. Such rules the Gothic architects are proved to have observed.—It is said that "columns or supports might be any number of diameters in height, and were only bounded by possibility." Let us admit this, and examine what practice has been pursued in other styles. By the elaborate experiments of Mr. Eaton Hodgkinson, on the powers of resistance of different bodies to compression, it has been proved, that in cylindrical forms, there is a certain proportion of height to diameter, beyond which it would be dangerous to go, the resistance rapidly lessening in proportion with the height. To pass that limit would endanger the stability of the fabric; to keep much below it would be a needless expenditure of material. From a non-observance of this propriety, we have frequently seen columns of harder material of the precise dimensions given to those of stone. Now such a practice is foreign to the principles of Gothic architects, as may be seen by the most casual comparison of their works in wood, stone, and metal; in which they had reference to the properties of each. The rules of classical architecture require, that no alterations should be made in the proportions of columns which are engaged, coupled or clustered, though it is clear, that, in accordance with the principle hinted at above, and a feeling, which, without reference to the results of experiment, exists in every mind, the same proportions should not be observed. At least, the Gothic architects pursued a different mode, on sounder views than have usually been attributed to them. Their circular columns, placed singly, were shorter than those which were clustered or united as shafts to piers and arches. Further, when these shafts were of great length, they were encircled by bands as at Westminster Abbey. In the Ladye Chapel at Hereford, and in the Chapter House at Chester, the isolated shafts to the windows are banded to the adjoining mullion by ties of stone, which are converted into features of decoration. But the absolute constructive necessity for such ties is shown in the failure of slender shafts, in which such precaution has been neglected. Shafts without bands, and at the same time of great length, occur at Salisbury Cathedral; while in the Ladye Chapel are isolated shafts, supporting the roof, of the slenderest dimensions, and uncombined with a larger column. Such examples are extremes, or exceptions to the usual practice, and though as in this wonderful edifice, calling forth our admiration and delight, they are not what the modern architect would emulate. I venture to assert, that we are justified in craving of those, who deny the existence of principles and proportion in Gothic design, that they should compare the cathedral, the abbey church, the parish church, and the collegiate chapel, marked each by clear and distinctive lineaments; that they should closely scrutinise and balance every minute part of a composition; that they should examine whether the different tendency or number of lines, the different character or quantity of ornament, or some other cause or influence, has not dictated a manner of treatment varying from that they have observed in another composition, but in strict accordance with the same first and inviolable principles of both; or whether the example is not such an exception to the usual style and principles, as all ages have witnessed. Our delight in Gothic architecture is indeed the result of elegant outline and proportion, richness of detail, sincerity and scientific construction, along with admiration of the high purpose and untiring labour of the architect, rather than of a "love of the marvellous," or mere respect for what is old. The "love of the marvellous," of which the Gothic architects are accused, was seen in the "large stones" of the Grecian temples, the columns of one block of the temple of Diana at Ephesus, in the temple of Jupiter at Agrigentum, in the costly structures of Baalbec and Palmyra, in the Colosseum, in the domes of St. Peter's at Rome, and Sta. Maria at Florence, and in the gigantic order and all the conceptions of Michael Angelo. "Another enemy to the beautiful, and even to the sublime," says Forsyth, "was that colossal taste which arose in the empire and gave an unnatural expansion to all the works of art." As it is beyond the power of man to create a style, all styles being the work of ages and of circumstances, rather than of architects, who should be able to infuse new beauties into all, and as, in the words of Reynolds, "it is vain to endeavour to invent without materials on which the mind may work, and from which invention must originate;" are these the styles for which we must close our eyes to the expressive architecture of our own land? Is there any distinction between the end sought in the colossal works of the Egyptians, the Greeks, and the Romans, and that "love of the marvellous" ascribed to the Gothic architects? or is not the raising of surprise a legitimate end of all architectural skill? I cannot think that the plan of the middle age church was wholly founded on *superstitious* associations, and that the spire and cross are not appropriate emblems of both the Catholic and the Protestant faith. From the plan of the cross result the most beautiful outline, both externally and internally, and the most captivating effects of light and shade. It is not exclusively Gothic; and no higher testimony to its merits could be gained, than its adoption by so great an artist as Sir Christopher Wren. The majority of the English churches are not cruciform, which is sufficient to show the form was not indispensable. That some particular sanctity was attached to one side of the nave in cathedrals, may be inferred from the fact that in the majority, the monuments on the southern side and in the southern aile preponderate. But it should at the same time be noted, that in several examples the monuments on the north side are equal in number, or nearly so; and, that at Wells, when there is a chantry under one of the southern arches, a corresponding position is similarly occupied on the north side. As regards the inclination of the choir to the south, I believe no perceptible inclination occurs in the *English* cathedrals; and at Litchfield, where an inclination to the *north* is discoverable by measurement, the variation is so slight, that I think few persons would discover it within the building. The ladye chapel, though generally at the west end of the choir, and certainly so placed with fine effect, is not unfrequently elsewhere. In the cathedral of Bristol, the "elder ladye chapel" is at the north side of the choir. A similar position is made use of at Ely.

But the strongest objection brought against the practice of the Gothic architects, is that their buildings have failed through want of constructive principle; and that though they manifested considerable enterprise and dexterity, they lacked that theoretical knowledge which grew under a better order of society, and "the chastening counsel of a Locke, a Newton and a Bacon." Now it cannot for one moment be supposed that the scientific knowledge of the middle ages approached to the learning of a Galileo, a Napier, or a Newton; nor be denied that the mass of the people were utterly ignorant. But the existence of a large number of mendicant friars, always at enmity with the regular priesthood, yet as ignorant as those upon whose fears they lived, seems to have led to the general belief, that all the Catholic clergy had little in their heads but a knowledge of bad Latin; or in their libraries, except the writings of the fathers. But, amongst the churchmen was preserved all the knowledge of the age; they directed the architectural works and the engines of the state; and though their projects were often carried out by less skilful hands, their expressed intentions bear the evidence of a knowledge of practical mechanics, of the composition and resolution of forces, which, it is difficult to conceive, could rest on any other than a foundation of geometry. Mere solidity is often best obtained in buildings, in which but little science is called into play; but with a greater expense of material and labour, and less scope for decoration and convenience.

be made out with marvellous care, he will yet turn to those monu-

Small scientific skill was required for the construction of the Druidical temple, or the Grecian portico; but from the increased use of the arch arose a new era in the art of building. Smaller stones were employed, with skilful arrangement of counterfort; and labour replaced by economy and facility of execution. With the change from the semicircular to the pointed arch, arose a still greater facility of execution, combined with a nearer approach to the advantages which had resulted from the principle of simple repose. But along with, though not necessarily resulting from the use of the pointed arch, a force was at work towards the ruin of many edifices, but for which the practice, rather than the theory of Gothic architects must be censured. The supporting columns of the central tower began to bend in the middle, as at Westminster; and other failures, all proceeding from one cause, took place little subsequent to the building of the several structures. It became necessary to connect the great piers of the tower, to prevent the recurrence; and counterforts were inserted at Salisbury, Wells, (Fig. 8,) and elsewhere. It has been thought that this failure of

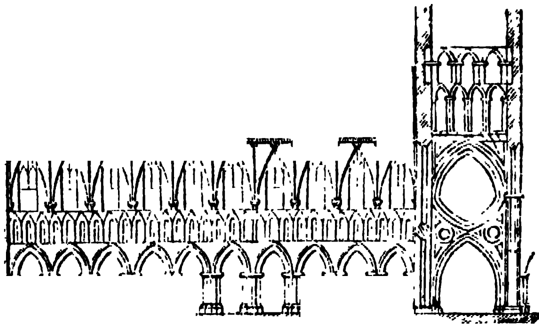


Fig. 8.—Section of Wells Cathedral, looking north.

the central piers was occasioned by their insufficiency as abutments to the adjoining arches; and this opinion seems to have been present with Sir Christopher Wren, in his proposal to add a central spire to the abbey. But I am inclined to think, that the breadth of the piers, coupled with the weight of the tower above, would be well able to resist the thrust of a *pointed* arch, were not some other tendency at work: and prefer the opinion, that the bending of each column was wholly caused by the sliding of the rubble work upon the back of its neighbouring arch. The more pointed the arch, the less thrust would it exercise, but the more would it tend towards the settlement. This seems a more probable cause than any other; there could have been no objection to increasing the dimensions of the column if necessary. The report on the state of Hereford Cathedral shows that this sliding of the materials upon the main arch of the tower, assisted by the subsidence of the foundation, has caused its western column to swerve from the perpendicular, and in the opposite direction, that is, towards the west.[6] The same thing has taken place at Aylesbury Church, in a like direction; and the displacement of the ashlering in the tower of St. Mary's, Redcliffe, was attributed, by Mr. Hosking, to the subsidence of the rubble work. Had the spandrils of the arches been laid in courses, which modern experience would dictate, such failures could not have occurred, and therefore no objection can be taken to the modern adaptation of Gothic architecture on the ground of insecurity. It may be remarked that there is some difference of opinion about the reversed arch at Wells—as to its merits as a composition.[7]

Though in "these piping times of peace," "armorial bearings" no longer distinguish the warrior on the field, they are still not exploded, nor have they ever been in any country; they still engage the patient attention of numerous antiquarians, and seem to be a legitimate mode of decoration in any style of architecture. One of those recollections of the past, which are stable, though the occasion has past away, they will yet long serve to shorten the labours of the historian, as now.—The so called economy of modern times has deprived our art of that sister, without which she is inexpressive, and incomplete; but there can be no other reason that niches should be "tenantless" in any religious edifice: and none that the *obscenities* of former times should be copied in the present. The exquisite richness of the Gothic foliage would be apt, from its very profusion, to cloy upon the mental palate, had it no immediate contrast, as with the grotesque and the satirical. Thus, as at York, we find the passions of men and the habits of animals depicted amongst the leaves of a capital or a bracket. In other cases we have the monogram IHS and other religious insignia. Though some of the carvings are sufficiently shocking to eyes polite, as for example, the gorgeuils, yet these are never "senseless;" they have always an expression in character with their purpose, and may safely be contrasted with the unnatural lions, the sphinxes, and chimæras of other schools of art. Though, in the sculpture of the earlier styles, forms were conventional, and a particular sentiment was expressed in an established mode, this severe style presents many claims to our admiration, though in execution, it can be as little compared with the later style, as can the marbles of Xanthus with those of the Parthenon. But good sculpture, and by Gothic architects, does exist, grand in conception as that at Wells, and perfect in execution as that at Westminster; and it received the admiration of our own Flaxman. Speaking of the interior of Henry VII's chapel, he says, "the figures of the tomb have a better proportion and drawing in the naked than those of the chapel: but the figures of the chapel are very superior in natural simplicity, and grandeur of character and drapery." But, of the sculpture of Henry V's chantry, the work of a century previous, he says, "The sculpture is bold and characteristic; the equestrian group is furious and warlike; the standing figures have a natural sentiment in their actions, and simple grandeur in their draperies, such as we admire in the paintings of Raphael." Could there be higher praise than this from so great a man? The vertical character of Gothic architecture does indeed demand in the garments, folds which may accord with the genius of the style; or rather eschews those contortions of drapery and whimsicalities of design observable in the works of the later Italian school, particularly of the followers of Bernini; and of which some idea may be gained from the engravings to the English edition of Palladio's works. If a group be viewed singly in a gallery or an apartment, where only *it* appeals to the eye, its forms may be influenced by the taste of the artist alone; but, in architectonic sculpture, a different treatment of the subject is demanded. A greater rigidity, or a more erect position seems necessary for statues, when combined with architecture, in all styles. "Their attitudes," says Chambers, "must be upright, or, if anything, bending a little forwards, but never inclined to either side. Their legs must be close to each other, and their draperies close to their bodies; for whenever they stand stradling with bodies tortured into a variety of bends, and draperies waving in the wind, as those placed on the colonnades of St. Peter's, they have a most disagreeable effect, especially at a distance; from whence they appear like lumps of unformed materials, ready to drop upon the heads of passengers." That excellence of imitation is not the highest quality of art, is readily granted, but it is not less true, that in some degree it may detract from our delight, by its very excess "reminding us that life and animation are wanting," and thus defeating the aim of the artist. For remarks on this head, vide Reynolds *passim*, in the lectures of the professor of painting at the Royal Academy, and in Mr. Eastlake's translation of Kugler's Handbook.—To him, who feels that a devotional character should be impressed on all monuments erected in churches, I suggest in favour of Gothic architects one practical argument—a walk through Westminster Abbey. There he will find architectural ornaments ruthlessly sacrificed, that square patches of black and white may occupy their place. He will see cumbrous monuments to some "periwig-pated fellow," or some courtier of a passing day, occupying a position, tardily granted or denied, to the mementoes of the philosopher and the poet. But though each individual hair of their wigs or their whiskers

[6] Journal, Vol. V., p. 371.

[7] The counterfort at Wells was probably coeval with the piers—that at Salisbury later in date.

mental effigies, recumbent in unbroken sleep, or with hands clasped in holy aspiration; and, overcome by the spirit of the place, he will walk with softer tread, his mind impressed with feelings of devotion, and with vivid recollections of his country's great.

In Gothic buildings, no construction is masked by decoration; no sham feature inserted to correspond with another that is real. Sincerity is the guiding rule, and geometry the instrument. In vaultings, the thrust of the main supporting ribs is concentrated at one point, and there counterabutted by a flying buttress, in the precise direction which the composition of the forces dictates. Bridged across the nave, it was further resisted by the wall buttress, and confined within narrow limits by the downward pressure of a pinnacle, until it found its limit in the earth. Now in this system of counterfort, (the principle of which it was hardly necessary to explain here,) we discover an adaptation of means to an end, surpassed *only* in the construction and action of the human frame. Thus, like the trellis on which the jasmine and the convolvulus entwine, the forms of pointed architecture are but the framework on which beauties are engrafted, evolving those beauties, but never sacrificing themselves to them, and even snatching peculiar graces from circumstances originally adverse. Gothic structures never disappoint, as almost every other edifice is sure to do. The first sight of the church, "bosomed high in tufted trees," the nearer approach, or the study of days, are alike pregnant with delight. The most skilful arrangements of contrast are displayed—in the low doors by which you enter the lofty pile; and in the spires which rise in every part of a level district. Also the contrast of dark to light, in such situations as the porch of Henry VII's chapel.

Whatever objections there may be to the practice of the medieval architects, these can have no hold against a modern adaptation of their style. We should work with all the skill derived from examination of Gothic edifices, and from analysis of the causes of failure in some, superadded to all the advantages which modern discovery affords. We should choose good stone, and select or prepare good foundations, protecting our buildings from damp and decay by drains and water pipes in place of the old gorgueils. And the result of our study of each form of ecclesiastical structure, combined with our invention, would be the raising of fabrics worthy and characteristic of the age, which the peasant and the peer alike would recognise, as expressive of religious uses.

THE CAUSES WHICH HAVE ENNOBLED ARCHITECTURE.

By FREDERICK LUSH, Associate of the Institute of British Architects.

(Continued from page 151.)

"If to do were as easy as to know what 'twere good to do, chapels had been churches, and poor men's cottages, princes' palaces."—SHAKSPEARE.

IT is not surprizing that the great churches of Europe, but especially those on the Continent, should so frequently present a confusion and discordance in their parts, when they were the production of many ages, against the revolutions of which they had to contend, and when, moreover, their construction was committed to many different minds, who it appears very obstinately differed from each other with respect to their architectural principles. However beautiful these varieties of style may be in the abstract, we like to see the same character, the same feeling and expression running throughout the whole, as if one mind alone presided over it. But it seems as if many architects loved to show their predilection for some particular school when called upon to restore or add to any existing edifice, and to act entirely as their own tastes and their own prejudices dictated, without reference to what their predecessors had done, in order to make their work of a piece with them. It is, perhaps, one of the weaknesses peculiar to genius. We think, for instance, of the Corinthian portico of Inigo Jones on the west front of old St. Paul's; and not only what this celebrated man, but many others have done, in their fondness for the ancient or their love of novelty, by introducing something from *Vignola* or something from the *Renaissance* on such noble monuments as those of Nôtre Dame, and St. Germain l'Auxerrois at Paris. It is in consequence of this, that all which is most beautiful in the Gothic in the best ages of its invention, lies scattered over those countries where a passion for it was most felt, and where it naturally best flourished; and it is necessary to accumulate and combine these in order to form a perfect cathedral.

For the finest remains of this sublime art we look to the churches of the 13th and 14th centuries; and although there is scarcely any country which does not claim it as its own, yet we select those of Germany, as this seems the soil from which originally it sprung and was matured; and as in the year 1277, when the famous Strasbourg pile was commenced, there was established in that town perhaps one of the oldest associations of masons, which is the chief lodge, and who have the honour of having built, not only this, but Cologne, and many other edifices, of which the Germans have reason to be proud. That they were not wanting in talent and perseverance for bringing to perfection the style of building of which they were the professed masters and had devoted themselves to, we have abundant proofs; great improvement was necessarily made in it; miscalculations on the composition and resolution of forces were corrected; no defects in their designs were permitted eternally to remain for want of previously studying their effects upon the eye; and every thing was done both theoretically and practically, to place the art on a firm and solid basis. We say the chief aim of art consists in producing the grandest effects with the smallest means; in giving to a structure the greatest strength with the least material; in constructing it in a manner the most advantageous for the purpose to which it is destined, and wherever no ignorance can be detected in *displaying* the art by which all these ends are accomplished. We turn, then, to the works of these builders, and find they did not live to pile up stones in vain, but attained these results with a most unrivalled success.

Their union, moreover, with a number of similar societies, all attached to and teaching the same principles, placed within their reach immense power and immense resources. One of the opportunities that was afforded them of the certainty of the correctness of these principles, was the wide field of observation that was opened to them by means of travelling. By the numbers likewise of the workmen they had at their command, the wages with which they rewarded their labours, and the industry that they excited among them, an employment was created which very much conduced to the happiness and well-being of the poorer class of people. But the good did not cease here. Men were everywhere occupied in erecting a church on a scale commensurate with the imposing rites of the Catholic worship. Superstition, too, in those ages, doubtless had no small share in producing the magnificent structures which were the wonder of the multitude; but we cannot blame them for this. It is not difficult to trace the weakness of our nature in everything, and to see it mingling even in what is most holy. At a period, therefore, less enlightened than our own, we cannot wonder if the hand should be somewhat prompted by superstition in rearing one of those beautiful and elaborate spires which rise above our houses and ornament our land. But if we feel it a kind of devotion to look upon it; if we endeavour when gazing upon it to

"—— withdraws our minds
From earth, and control our thoughts 'till we have
Got by heart its eloquent proportions."

let us not say that those who reared it were degraded by any such motive; but rather imitate their zeal and rival those efforts of human skill and piety; though their authors were once turned into ridicule by the common people, and thought no better than fanatics. It was this class of persons whose co-operations were the means of ennobling architecture during the middle ages; for whom no art could be too refined, as no religion too sublime. They considered it impossible to conceive any building too grand or too splendid in which to celebrate its solemnities; they wished to make it resplendent with the inventive genius of the pencil; and if they could not possess the frescos of such artists as Raphael and Michael Angelo, those champions

of the Christian art, at least to cover its walls with painting and sculpture, as we see in many old Gothic churches of the north, on which some of the pictorial splendour of Italy and the warm countries seem to shine; and on whose lofty ailes and carved pavement, the sun, through the diapered windows, sheds its gorgeous colouring.

Such an edifice as that of which Steinbach was the architect-in-chief, the glory of whose construction none but the ignorant would gainsay, was a powerful motive to induce the inhabitants of other cities who could not boast of such a monument, to build such another; that at least they might not be thought wanting in zeal for, or behind-hand in thus making a proclamation of, the new faith which at that time was spreading itself through all Christendom. Accordingly we find a striking similarity among all the great churches of the 13th and 14th centuries, and a conformity in their plan, arrangement, and decoration, which leads us to believe, beyond a doubt, that no other form was so well suited to the mode of worship, both in these and subsequent periods; and that it proceeded from some regular society, such as the freemasons, whose principles were the same, and for a time, universal. The disposition of these cruciform churches, sometimes without, but more generally with, a range of side chapels, corresponding with the division of the side ailes, was, from the time of Constantine, more or less imitated by all civilized Europe; and there needs not a stronger argument in their favour, than in the difficulty that was experienced whenever an attempt was made to improve upon it. Abolish it, and with it we abolish the ceremonies of the religion for which it is intended. But this is not all. A departure from the system exhibited in these ecclesiastical buildings, has been attended with the most dangerous consequences to art. It has been the ambition of all nations, who have excelled in architecture, and been masters of its true principles, to exhibit them, even to an ostentatious degree, in their proudest fabrics. Such a display of science commands attention, though it might be said it was done for mere love of glory; and this was particularly the case in the works we are considering. Now the moderns are too apt to do just the contrary; to disguise the construction of their edifices, that is to say, such churches as those which are unworthy of the name, and whose construction, from the sordid and unscientific means employed upon them, it was wisest to conceal. But can anything be conceived more degrading to art; and is it not to such causes we owe many failures that have occurred in modern church-architecture? The architects of any one of the splendid churches alluded to, would not have been guilty of anything so mean. They felt it was one of the requisites of art to exhibit undisguised the great triumphs which the mind had made in it; and to raise pleasure, or excite emulation, in the souls of all those who contemplated such a production of human wisdom. It might appear strange, therefore, that Wren and Jones, both of whom were at the head of such an institution, so little understood or appreciated that Gothic, which was once such a favourite among its members. But the cause will be easily explained, if we consider it was the fate of this noble art to decline after it had reached its meridian point; that a hankering after something new and uncommon hastened its downfall; and that its beautiful proportions and details became obsolete when the taste for the architecture of the Greeks and Romans naturally brought on the revival of classic antiquity.[1]

The same uniformity of character, mentioned above, may be observed in public works of a civil kind, such as the castles and bridges. The former were absolutely necessary at a time when wars were frequent; and the latter afforded such security to travellers, who might otherwise be exposed to pirates on the river, that the building of them was considered an act of charity; and those to whom they were entrusted were styled *fratres pontifes*.[2] It appears they constructed a great number in Italy and in the southern provinces of France; and the remains of these old bridges and chateaux, are often so picturesque, that it is worth while to undertake a journey on purpose to see and study them.

Now it will not be denied that architecture owes much to the existence of such fraternities; especially during the middle ages, when they were like so many learned republics; when kings and nobles were proud to take a part in their proceedings and assist in promoting their enterprizes. There is no period of history in which we do not find men associating together when bent upon accomplishing any object to which individual exertions were, of course, unequal. The ancients could never have succeeded in their temples, their roads, their thermæ or their aqueducts, had they not condemned their slaves, and all whom they had conquered, to labour on these great works. The population and industry of one single kingdom were not sufficient. Nearly all Asia, for instance, contributed to the building of the famous Diana of Ephesus: and one of those prodigious stones in the pyramids, which almost alarms the inhabitants of the north, must have required in placing it just in its proper place, or even in managing the engine by which it was raised, double and treble the number of labourers which we usually employ on one of our public edifices. In more recent times it was the custom, when a palace, a castle, or a church was in progress, and workmen were scarce, to authorize officers to collect them wherever they might be found, in the same way as they *press* men for the militia, and detain them in the king's service, as it was called, until the works were completed.

A powerful means of ennobling architecture, as well as any pursuit on which the human mind may be engaged, is found in this principle of concentration. The idea of bringing together the fruits of the industry of past ages, naturally originates among all civilized societies. We look in all flourishing cities for those academies for the arts, those museums, and schools of design, which are among the happiest evidences of the power and well-directed wealth of a nation, and without which the arts would make but a very poor and feeble progress towards perfection. We recognize this principle, moreover, in those encyclopædias of knowledge, whose treasures enrich the libraries of Europe, and which are as indispensable to the man of letters as the collected remains of Greek art are to the sculptor; nor do we hesitate in classing the founders of such works and such repositories among the benefactors of our race. For what would be the condition of the fine arts or of the human mind if London were without its British Museum and Royal Academy; Paris without the Louvre and Ecole des Beaux Arts; or Italy without its Vatican?

(To be continued.)

[1] See Ducange's "Glossarium," and Bishop Gregory's account of them.

[2] Here, however, I recollect I am not doing Wren justice, for notwithstanding the passion for the antique, which prevailed in his time, he proposed the erection of a cathedral in the Gothic style, the original drawings of which are at Oxford. Perhaps he was the only man who conceived at that period such a design. Every one knows his admiration of the construction of the roof of King's College Chapel.

THE BRITISH MUSEUM.

Public attention is so engrossed by matters connected with the new "Palace at Westminster," or by other schemes of improvement for the metropolis, that no one seems now to take any interest in—to care for, or even to remember the British Museum, just as if it were of no importance whatever. This indifference may probably be owing to all hope having been long ago abandoned, of that structure being rendered a worthy piece of monumental architecture; for as far as it is built at present, its exterior is a perfect nullity. Still, even at this "eleventh hour," there is opportunity for redeeming its character, by making something satisfactory of the façade which has to be added, and will now be commenced, we presume, at no very distant time. For what remains to be done, however, that which actually has been done is so very insufficient a pledge, that it is to be hoped we shall be afforded the means of quieting our misgivings, and ascertaining beforehand what we are to expect. Some, or rather now many years ago, Sir Robert Peel declared in Parliament, that the design for the front of the British Museum was an architectural *chef d'œuvre*: we had our doubts at the time, and so far from being dissipated, they are now stronger than ever;—or to speak out more plainly, we have very

little doubt at all—on the contrary, feel most uncomfortable assurance of our worst apprehensions being realized, unless some stir be made in the matter.

Sir Robert Smirke himself may be just as admirable an architect as ever he was; yet a change there may be, if not in him, in others: the public have obtained some little more insight into architecture than they possessed ten or twelve years ago, and what they would then have thought very fine, they may now consider no more than barely tolerable. The coming before or the coming after the new Houses of Parliament, which ten years ago were not even so much as dreamt of, makes a prodigious difference; and not they alone, but many other things have come up in the interim, which are likely to take architectural precedence of the Museum.

As the intended façade has been so very long delayed, it is to be hoped that it will not now be hurried after all, but be delayed a little longer until the public shall have been informed what the design really is. Why should there be so much silence and secresy in regard to it? for if the making the inquiry we here recommend, would seem to imply want of confidence in the architect's taste and ability, the extreme reserve shown on his part, and that of those who are more immediately concerned in the matter, equally implies very great mistrust in the design, and strong suspicion that it will not bear the test of much examination. It therefore *looks* as if it were intended to adopt the safer and more convenient course of evading public opinion until it can interfere to no purpose, but merely express itself in *post facto* grumblings. Let us not have another egregious instance of architectural smuggling as to public buildings erected at the public cost: there are by far too many such already; and the National Gallery alone might operate as a corrective warning—certainly should serve as one to the architect of the British Museum.

The façade for the Museum still affords, as we have already observed, an opportunity for a fine display of architecture, but whether the opportunity will be fully turned to account, is what we must wait to find out, when it will perhaps be discovered that comparatively nothing has been made of it. Let us *suppose*, however, that the design is one of surpassing beauty: why then, we ask, should Sir Robert, merely for the sake of taking the public by surprise, have defrauded himself in the meanwhile of all the credit to be derived from it, and which he might have begun to enjoy very long ago? Had the same system of close secresy been observed with regard to the Houses of Parliament, Mr. Barry would not be altogether quite so celebrated at present as he actually is. Of his edifice, we are permitted in manner to enjoy the beauties by anticipation, and to applaud the magnificence of the Victoria tower, that *is to be*. But in regard to the *is-to-be* façade of the British Museum, nothing is suffered to transpire, nor is curiosity allowed to be gratified. The only positive information relative to it, afforded at present, is that furnished by a ground-plan, published in a parliamentary report of 1838. From that, we perceive that the main building will have a continued colonnade in front, not extended in a single line from end to end, as in the façade of the museum at Berlin, but breaking round the advanced extremities or wings, and forming in the recessed portion of the plan between them, an octastyle, advanced one intercolumn, by an additional line of columns in that part. So far, there will, no doubt, be considerable richness and play in regard to columniation, and in that respect we shall get a step farther than we have yet done in the Anglo-Grecian architecture of our metropolis. Yet as provision seems to be made for something more classical, all the more desirable is it that the most should now be made of it, and that the idea should be perfectly wrought up; otherwise the disappointment felt at perceiving how greatly the whole falls short of what it will seem to have been intended to be, will even convert the satisfaction derived from its good points into vexation. The promise made by the plan, may be totally frustrated by the elevation; and such will certainly be the case, should there, after all, be nothing more to admire in the design than the circumstances indicated in the former. If we are to look to the inner court as affording a specimen of what the external order is to be, we feel no eagerness at all to see the façade erected, nor even care if we ever behold it, since unless greatly better than that, the order will be exceedingly unsatisfactory in character, and will prove all the more so, because its tameness and dryness will be all the more offensive, in consequence of the greater pretension made by the *columniation* itself. Something more than Sir Robert's formal stereotype Ionic is here required—something far more worthy of the particular occasion, which is no every-day one. Let him, therefore, for once venture to disregard scrupulous adherence to the authority of precedent, and give us upon his own authority what may be quoted as a precedent by others. He can very well afford to do so, since he has long ago done enough to fully establish his character as a "classical" copyist, and has yet to convince us that he can be anything more than a copyist. Merely to do again what he has already done so oft before, can hardly add another laurel to his wreath. Let him then forget his Post Office Ionic, his College of Physician Ionic, and all his other *various* (?) Ionics, and now give us an example of what may be made of an order whose "capabilities" are by no means so exhausted as to afford no fresh ideas. At all events let him bestow some study and greater finish upon his entablature, and let him by all means be less grudging of cornice. Some enrichment of frieze, and sculpture in the pediment if there is to be one, as we suppose there is, over the central octastyle—would not be amiss, more especially as we have at present no one example in the metropolis, in which sculpture is applied in both ways.

There is, indeed, one thing in the plan that is so far from promising well, as to be very ominous, which is, that there will be windows throughout within the colonnades. Even if rendered ornamental features in themselves, such apertures must prove injurious to the general composition, and at variance with its columnar and polystyle character; besides which, windows are by no means the architect's forte, nor does he ever attempt to turn them to account in his designs. Such being the case, instead of making any favourable promise, the windows rather *threaten* to prove blemishes and positive defects, and to render the façade little more than a variation of that of the Post Office, a respectable quaker-like building, encased in columns; consequently, though both the one and the other may be unexceptionable in themselves, the combination is likely to prove very unsatisfactory unless it turn out in this instance something very different indeed from previous specimens, by the same architect. Very much, indeed, will depend upon a variety of circumstances in the elevation, which, even were we acquainted with them, can no more be described than can all the traits and lineaments that contribute to make up the general air and expression of a countenance, and which, though taken singly, seem of no importance, are in reality of the greatest, with regard to the ensemble and the general impression made by it.

Willing to entertain hopes, we feel that we have very great cause for fears, and not least of all on account of the reserve manifested on the one hand, and the indifference on the other, relative to the intended façade, notwithstanding that so very much depends upon it, because it is that, and that alone, which can now be made to render the building one of "monumental" aspect externally—and by "monumental," we mean something more than that degree of it derived from size and material, or from the mere introduction of columns. We have a right to look for even very much more than negative merit upon such an occasion, since should we obtain no more than that, the building will prove if not exactly an architectural failure, another lamentable instance of a noble and rare opportunity that will have been nearly flung away.

If—as is very likely—our remarks shall be thought to exceed the due limits of criticism, by prejudging what is not yet in existence, and by imputing to it defects imagined by ourselves, we do not pretend to say that such is in no degree the case. Our saying anything at all may be officious, impertinent interference; but let there then no longer be any room for making unfavourable and ominous surmises, as there certainly is at present. As to forming a judgment beforehand, that is matter of very little difficulty or uncertainty where Sir Robert Smirke is employed, for all his productions have so little character except that derived from his peculiar mannerism, that it is hardly possible to

err in calculating the result of what he is about to do from what he has done—and that not very much in his favour. Should we here have erred altogether—why so much the better; and most happy shall we be to find that Sir Robert will have greatly surpassed not himself alone, but most others in the profession; and that the façade of the British Museum will show what may be done by us in the Grecian style, no less satisfactorily than the new Palace at Westminster already shows what can be accomplished by us in the Gothic. May the one prove a worthy rival to the other, and may there be cause for applying to them the remark—*Pares magis quam similes!*

CANDIDUS'S NOTE-BOOK.

FASCICULUS LI.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. There is just now quite a cartoon fever or epidemic raging among us. We have "Hand-books"—should they not rather be called "Eye-books?"—which profess to teach us how to look at cartoons; and an advertisement has lately appeared with "THE CARTOONS" prefixed to it, which begins by informing us that the "present character of art is contrary to the eye, and the evidence of common sense," and concludes by assuring us that there is no hope for success in cartoon drawing and fresco painting in this country, "till the laws of the eye be made the standard of accuracy, as laid down in Parsey's 'Science of Vision.'"! This is, perhaps, one of the most ingeniously plotted things of its kind ever produced—quite a master-piece in the art of advertizing and its manœuvring: yet although admirably well-timed as far as the public are concerned, quite the reverse for the poor artists, who now discover that they should have bought the book *before* they set about their cartoons, and not after their works have been hung up in Westminster Hall. By the bye, how did the great *Frescanti* of Italy—or, for the matter of that, how have artists generally—been able to do so well as they have done, in the present benighted state of art, contrary as it has been all along to the "evidence of common sense"? Have the whole world, artists and critics alike—been hitherto labouring under a fatuous delusion, fancying things to be very fine which are now proved (?) to be contrary to common sense! Truly deplorable in itself, such delusion seems also to be hopelessly incurable, since no cures have been wrought by the Parseyian system. That not a soul can be induced to adopt it, is evident, since had it been applied at all in practice, the effect would have been too striking to escape notice. Only one experiment (the first and last) has been made with it, and that was by Parsey himself in a drawing exhibited at the Royal Academy, which, if not at all satisfactory in any other respect, completely satisfied the public as to the exact value of the "Science of Vision." Why it should now be recommended more particularly for cartoons, it is difficult to guess, for it is little more applicable to them than to flower painting. On the contrary, such a subject as Barry's Victoria Tower would be a capital one for showing the wonderful and curious effects produced by Parseyian perspective!

II. In making choice of a style for a building, it is necessary to consider not only if the style be suitable for the occasion, but also if the occasion be suitable for the style, and one where it can be shown to advantage. Should the building be of a kind to require a number of windows, Grecian architecture is not to be thought of, for though you may put Grecian columns, the genuine classical physiognomy of the style will be lost. Neither can the Italian *palazzo* style be employed to advantage, except where space can be allowed for it, so as to preserve its character in regard to its *proportions*—that is, the proportions between solid and voids. In this style narrowness of piers between the windows, and want of breadth between the windows on one story and those on another, is no less injurious to character and effect, than is wide intercolumniation in what professes to be Grecian architecture. The fault in either case is nearly the same; the difference being, that in the latter the defect is that of meagreness and "sprawlingness," in the other, that of littleness and "squeeziness." Much, therefore, as that particular species of the Italian style has to recommend it for street architecture, hardly is it applicable here, owing to the narrowness of the fronts of our houses. Mere continuity of design may be obtained by uniting several houses into one general façade, yet that alone is not sufficient, because it does not increase the space between the windows and the several floors, does not at all alter the proportions, but only increases the *number* of windows by repetition, and no more alters the character in regard to design, than the number of yards of it measured out alters the quality of a silk or other stuff.

III. The sticklers for precedent, and those who would fain discourage, or if they could, even prohibit all invention, and reduce architectural design to a system of mere copying, give us no very high opinion of their own powers. They dislike invention and originality, for pretty nearly the same reason that the fox objected to the grapes as being sour, because he could not get at them. Again, they dislike novelty because it "puts them out." Puzzled at what they are unaccustomed to, and having no positive principles of taste to guide them, they decide at once that that for which no established authority can be adduced, must *therefore* be illegitimate and licentious, and *because* it deviates from standards and rules, it must likewise run counter to correct principles of art. Mere novelty, indeed, is not originality, in the better sense of the term, and it certainly would be absurd to admire as originality and inventive imagination, the merely doing that which had never been done before. But then it is in the same manner, mere prejudice and bigotry to condemn a thing, however it may be done in itself, for no better reason than because it is now done for the first time. If an idea be a happy one in itself, what matters though it be not exactly legitimate, and though we cannot trace its pedigree back any further?—rather ought it, on that very account, to be all the more prized, as a valuable addition and real acquisition to our architectural stock. There is a vast difference indeed between crude, capricious whims and original ideas. To be original, requires not invention alone, but patient study also. It would be too much to expect that even the happiest idea should present itself to the mind all at once, fully matured, and in all the perfection it is susceptible of. Originality, too, consists not only in the putting forth entirely new ideas, but in the power of imparting freshness to what has become common-place, and of bringing out beauties that seem not so much to be now first discovered, as to have been before overlooked where they were lying for the first comer. By our attempting to keep art stationary, and allowing no fresh current of ideas to flow into it, it is at length rendered *stagnant* also, becomes dull and sluggish, and degenerates into a system of plodding routine and copying, without either feeling or intelligence.

IV. There are some serviceable hints to be derived from Westminster Hall, as now fitted up for the exhibition of the cartoons. It enables us to judge what would be the effect of a public picture gallery similarly planned, and formed out of a single large apartment, divided into avenues of convenient breadth, by means of screens carried up only a moderate height, so as to leave a lofty open space over head, showing the whole of the general roof or ceiling. In regard to this last mentioned circumstance, the appearance of the Hall is very striking, and the fine timber roof seems in some degree of greater expanse than before, owing to the space below being contracted. In fact, the Hall and cartoons together form quite a picture, especially when the sun breaks in towards the latter part of the afternoon, at which times, in addition to the sparkling brilliancy and catching lights where its rays directly fall, a glow is diffused over the whole. Even when the sun does not shine at all, there is a sufficient degree of light—subdued and quiet, but still sufficient, though it proceeds chiefly from the single large window at each end; for if those in the roof have been enlarged, the others beneath them have been stopped up. There are, therefore, no side windows except such as are very high up; yet though, as we may convince ourselves, it answers here, were the same mode to be

proposed for a church, it would be objected to as totally inadequate. It seems to be one of our prejudices, that we cannot have too many windows in a building, nor too much light, as if a strong light must produce a corresponding degree of effect; whereas it more frequently diminishes and sometimes quite destroys it.

V. The Nelson Monument people would have done a good work, if, instead of hoisting up an enormously expensive column (for at the best the effect will be in no proportion to the cost), they had offered to remove the present trumpery-looking screen of the Admiralty, and erect in lieu of it a low but simple and dignified architectural elevation, the centre of which would have served as a basement for some sort of superstructure forming the "monument" itself, adorned with sculpture, and surmounted by a colossal figure of the hero of Trafalgar. There would surely have been neither impropriety nor want of meaning, in so attaching to that building a memorial of one of the most distinguished of British admirals. At all events the Admiralty would have had what it now very much wants—something to mark it to the eye, and to intimate that it is a public building, and one of some importance—at least in its purpose. It may, indeed, not quite unreasonably be objected that any piece of monumental architecture of the kind erected in front of it would neither have improved the actual appearance of that building, nor rendered it the friendly service of shutting it out from view: but that, on the contrary, the building would have shown itself as an unworthy accompaniment to the monument. Still there would have been no very great difficulty in contriving that the monument should appear an independent composition not otherwise connected with the "large house" behind it, than as being erected in the open space in front of the latter, as affording a convenient site between that house and the street. The site itself being somewhat confined would have been rather a favourable circumstance than the reverse, because the monument would have been of greater comparative or proportional magnitude. As a piece of colonnaded architecture or façade, the present screen looks positively diminutive; but an erection of the same dimensions might be made to appear almost colossal as a portion of a monument reared in the centre of it.

NOTES ON EARTHWORK, &c., UPON RAILWAYS.

Article VII.—Principle and Construction of Earth Wagons.

In a former paper (*ante*, p. 186, vol. v), when treating of the "plant" employed in excavations, the cost of earth wagons and the expence of repairs were fully stated. I am, nevertheless, induced from the little information to be obtained, to make wagons the subject of an entire paper. I will first allude to the introduction of wagons for railway purposes. Mr. Nicholas Wood, C.E., in his Treatise on Railroads, p. 12, states, on the authority of Gray's Chorographia, published at Newcastle, 1649, that "the carts employed in conveying the coals, were in 1602 called "waynes," and the carriages introduced by Master Beaumont, "wagons," and also that ever since that period the carriages employed upon railroads have been designated by the latter name; we may therefore infer, that the wagon of Mr. Beaumont was applied upon a railway, and that he was the first to introduce them into the north." Also, page 16, the ground being formed pretty even from the pit, the whole length of the intended railroad or 'wagon way,' as it was termed." Here we have the ancient term retained in the modern nomenclature of "railway," not railroad, which is contracted to rail, in town. The wagons which are now used to carry coals, quit their load at the bottom, it being hung on hinges, and the form of body is hopper shaped, and they are made to carry 53 cwt.

Earth wagons are used in the making of railways for conveying the excavated soil, and are of two descriptions, called End Wagons and Side Wagons, from the direction in which they discharge the earth, which is done by a tilt like a tilt cart, the end or side being raised as the case may be. The timber framing which carries the hinge on which the body of the wagon turns in the act of tipping, is called the "soles," and sometimes the framing of the body of the wagon is called the upper soles. The form of the body is generally nearly square; the chief desideratum is that the construction should be simple, and rigid or firm, and that the height should be no more than will allow the wagon body sufficient elevation for the earth to leave it with the impulse that the wagon has obtained before coming to the tiphead. The annexed engravings, Figs. 1 & 2, show the construction of one of the wagons used on the North Shields Railway, drawn to a scale of 3 feet to the inch. The following is a specification describing the construction. The "soles," *a*, of the underframing to be 6 in. deep by 5 in. broad, with three cross "sheths," *c*, 6 in. by 4 in., having three bolts 1 in. diameter, one on the side of each sheth to keep the soles together. The soles, *b*, of the upper frame, also, to be 6 in. by 5 in., with two cross sheths, *d*, 6 in. by 4 in., and two iron bolts the same as the under frame; these two sheths, *d*, to be morticed into the soles, *b*. Besides these, the upper frame to have four cross sheths, *e*, 4 in. by 3 in. thick, projecting over the frame and wheels on which the bottom deals are to be fixed. The length of the cross sheths, *e*, to be such as to make the wagon 6 ft. 6 in. broad at the hind end, and 6 ft. at the fore end, measured along the bottom deals, and the length in the clear of the bottom to be 6 ft. 9 in. and the top 7 feet. The "cleading deals" are to be 1¼ in. thick, of elm or oak. The top sheths, *c*, to be bolted down to the soles, *b*, with ½ in. bolts, a cross sheth, *f*, to be bolted down to the undersole, *a*, to support the front part of the wagon.

WAGON, NORTH SHIELDS RAILWAY.

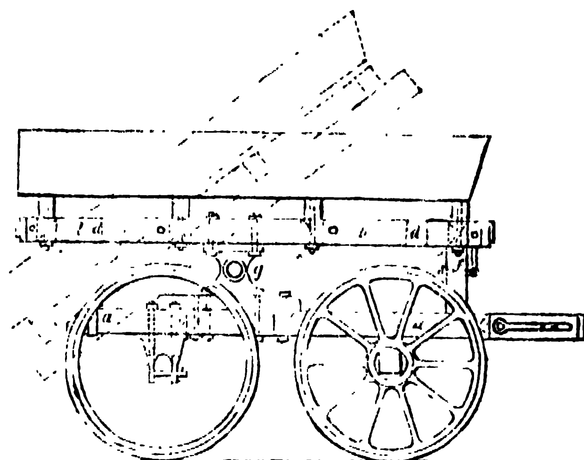


Fig. 1.—Elevation.

Plan of Top.

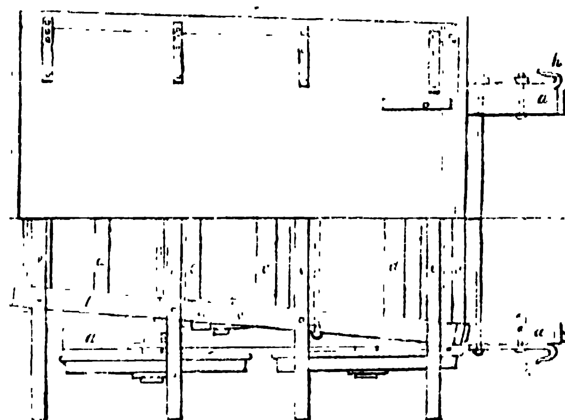


Fig. 2.—Plan of Under-framing.

The framing to be all of good English oak; sides and ends to be 12 in. deep and 1⅜ in. thick, also of oak or elm, and connected with kneed straps to the cross sheths, *e*, these straps to be 2¼ in. by ⅜ in. thick, sunk flush with the surface of the deals, and fixed with ½ in. bolts. The distance between the outside of the upper soles at the hinder end to be such as to allow them to come between the inner sides of the under-soles when the wagon is being emptied. The door or back end to be made to lift off. The end of the soles to be hooped with iron, 2 in. broad and ¼ in. thick. The joint or hinge, *g*, for the coup, to be formed according to the sketch, so as to give a broad surface to bear on. The wheels to be 3 ft. diameter, and the naves cut and hooped with iron, and to weigh cwt. qrs. lb. each. The axles to be turned and of the best scrap iron, and the whole to be completed in a substantial and workmanlike manner.

Remarks.—If it be objected that the upper soles, *b*, are placed diagonally, they may be put parallel with the inside of the under ones, which then might be shortened at the long end, and the crook, *h*, for traction attached to the under side; but in this there is a disadvantage, for if they come in contact with other wagons, the shock will be given to the coup, which throws a considerable strain upon the joint or hinge. The size of the wheels might be reduced to 2 ft. 6 in., but I do not think them too large, viz. 3 ft.

The next description of wagon, shown in the annexed engravings, Figs. 3 & 4, does not tip from a joint, but slides along rollers or

WAGON, BRANDLING JUNCTION RAILWAY.

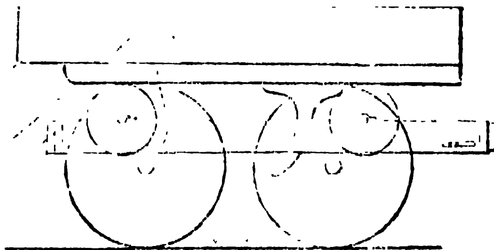


Fig. 3.—Side view.

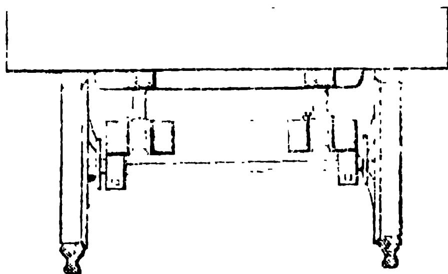


Fig. 4.—Transverse section.

sheaves, with a curved stop attached to the body, which arrests the sliding motion; the momentum causes the body to tilt up. This construction possesses many advantages; the wheels are large, and the weight is well distributed amongst them, it carries a large quantity, and is at the same time low; it is also easy to tip, the hinder sheaves being set a little higher, it almost runs when the catch is disengaged, two men at the embankment end can easily recover the coup. I sent a sketch of this construction to a friend who wished to make some; he inquired all over the north, of parties who would leave no stone unturned to serve him, yet he could not learn anything about this construction except from the sketch I sent. I mention this to show the difficulty of collecting information of this kind, as most parties make a mystery of trifles, who are engaged in such constructions. It is one of the attributes of want of education, and an external sign of a contracted soul. The wagons used on the Midland Counties Railway were similar to those just described, excepting that the sheaves were 8 inches diameter, and set lower, within the thickness of the under frame, so that the construction is a little lower than the former.

WAGON, HARTLEPOOL RAILWAY.

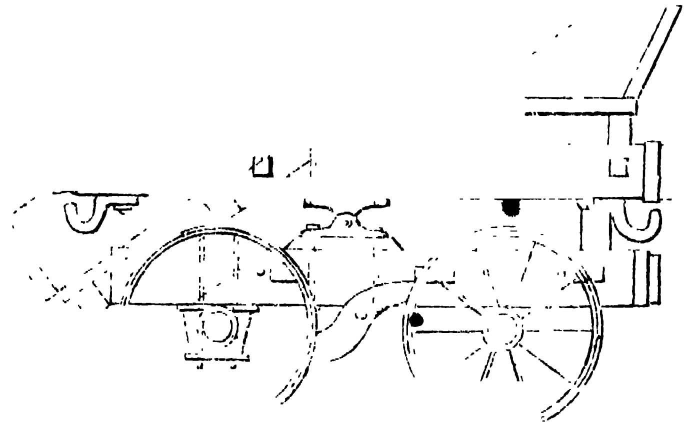
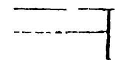


Fig. 5.—Side view.

Plan of Top.



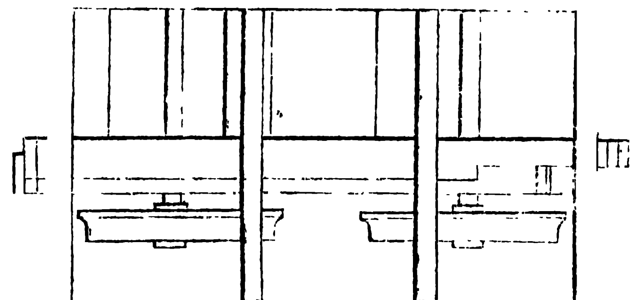
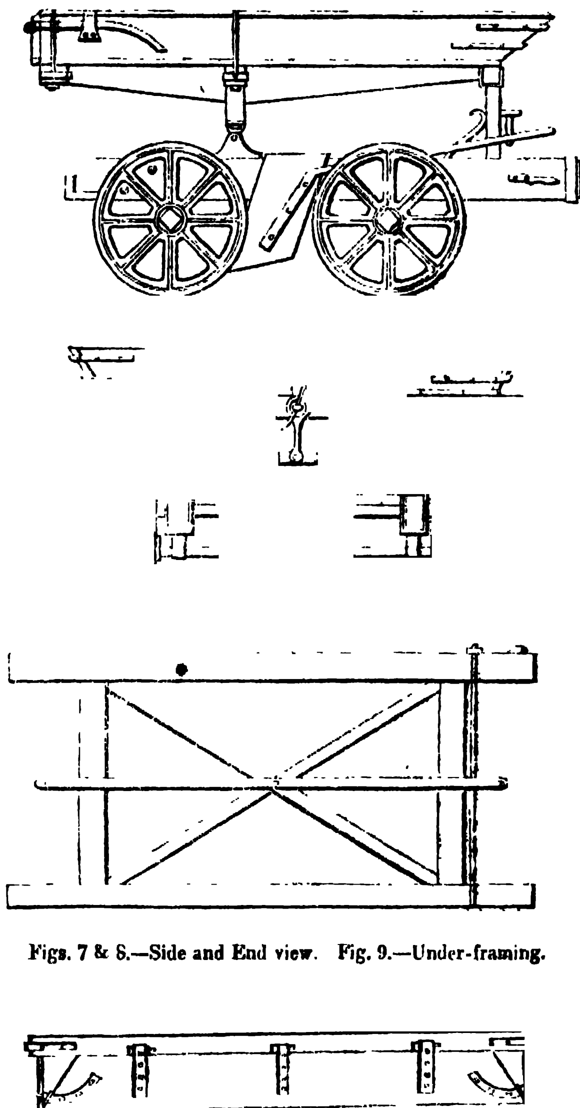


Fig. 6.—Plan of Under-framing.

Figs. 5 & 6 show a wagon used on the Hartlepool Railway: it tips from a hinge, and the draw bar is attached to the body of the wagon, and the upper and under frames are of nearly equal lengths. Figs. 7 to 10 show the construction of a wagon used on the Great Western Railway, drawn to a scale of 3 ft. to the inch. It is nearly similar to the last, excepting that the draw-bar is attached to the under frame and that the upper and under frames are of unequal lengths, which is a decided improvement, as it leaves a space between each wagon, so

WAGON, GREAT WESTERN RAILWAY.



Figs. 7 & 8.—Side and End view. Fig. 9.—Under-framing.

Fig. 10.—Tail-board.

that when an accident happens, the driver has some chance of escaping from being crushed between two wagons when they buff against each other. The following are the dimensions of this wagon; length on the top, 8 ft. 3 in., and bottom 7 ft. 8 in; breadth at top in front, 7 ft. 2 in., and end 7 ft. 8 in.; the bottom is 1 ft. less, and is 1½ in. thick; the sides and end are 2 in. thick, the bottom is 1 ft. 5 in. above the under soles; the soles of the under frame, 5 in. wide and 8 in. deep, the sheths, 5 in. by 6 in.; diagonal braces, 3 in. by 6 in.; width in clear of soles, 3 ft. 3 in.; length of soles, 8 ft. 3 in. Wheels 2 ft. 6 in. diameter. I must observe that considerable talent and experience was employed in consultation upon this wagon before it was adopted; it is of maximum size, low, firm in construction, and strength of materials well proportioned; the appliances of the break, and disengagement of the tail board, are skilfully applied. As the draw bar was found not to answer so well when attached to the body, it was removed and fixed to the under-frame, and that by the elongation of the under-frame the shock is given to it and not to the body; therefore the hinge which is most liable to be broken, receives no shock. I can fully recommend this form of construction.

On the Midland Counties Railway, a wagon of a different construction to any of the preceding was used, both the sheaves and joint being dispensed with, the whole body of the wagon being lifted up from the hinder axle in the act of tipping, and the two axles being retained at an equal distance, so that the wagon falls to its original position as soon as the coup is recovered. I have seen wrought iron used for bodies of wagons of this construction, which answers a very good purpose.

Several attempts have been made, but invariably without success, to combine the end and side wagon in one construction, by making the body of the wagon to revolve. Mr. Cuthbert Burnup made one so early as 1829, for the Newcastle and Carlisle Railway as a pattern, which I think obtained a premium. Wagons of a good construction are a very material point for the consideration of a contractor; and as the days when Banks flourished are past, they are the main thing a contractor has to rely upon for a profit, if there is to be one in the present day.

The diameter of wheels for 1½ yard wagons is usually 24 inches, and for 2½ yard wagons 30 inches. The iron work in each wagon consists of draught hooks, draw bar, angle plates, breaks, tail-board irons, coupling chains, bolts and hoops. In taking dimensions, hoops are all outside measure, and bolts are measured from inside of head to outside of nut. In one wagon nearly 400 lb. of iron is used, including say a dozen hoops and twelve dozen bolts. The best wood is elm of English growth, which is better than oak, not being affected to a similar extent by the abrasion.

A wagon made to contain 3½ cubic yards, is found in practice to be too large, 2½ yards being found better, and in some cases they are made to contain only 1½ cubic yards. The axle's diameter should be in proportion to the weight of the wagon. The bearings are internal, not as trucks and carriages for passenger traffic. To obtain a maximum effect, the pressure per square inch of surface should not exceed 90 lb. The friction of attrition alone is $\frac{1}{10}$ of insistent weight. The axles are generally 3 in. diameter, and the breadth of the bearing 4½ in.

In the execution of the Willesden contract on the Birmingham and London Railway, the contractor's outlay for rails was £4767, and for wagons £3588, together equal to £8355. At the completion of the contract, the rails and wagons were sold for £3237, causing a deficiency of £5118, for a distance of ¾ mile, and for the removal of 837,000 cubic yards, which is equal to about 1½d. per cubic yard. The greatest estimated quantity of earth capable of being moved by one wagon in a year is 5000 yards; the wagon will require renewing after three years' service, when the value of the old materials, supposing the cost to have been 16*l*. would be about 4*l*.

Although the construction of earth wagons and coal wagons are dissimilar, yet the amount of capital employed in the more permanent operation of conveying coals is not so much proportionally greater as would at first sight appear. On the Brandling Junction Railway, a thousand wagons are employed, at a cost of £13,000; and the charge per annum for repairs and interest is £4000. The company have taken them into their own hands. The Midland Counties Railway expended nearly £7000 in coal wagons, for the use of which they charge at the rate of one farthing per ton, and a toll of 1*d*. per ton; and estimate depreciation and repairs at 14 per cent per annum. The North Midland charge 1*d*. toll, and parties find their own wagons, the company having no stock of wagons. The cost of plant for earthwork under a mile lead, including all expenses, is generally taken at 2¼*d*. per yard, being 1*d*. for rail and 1¼*d*. for wagons, or half the cost of labour; and in a former article I showed that nearly £7000 was spent in one contract in plant alone.

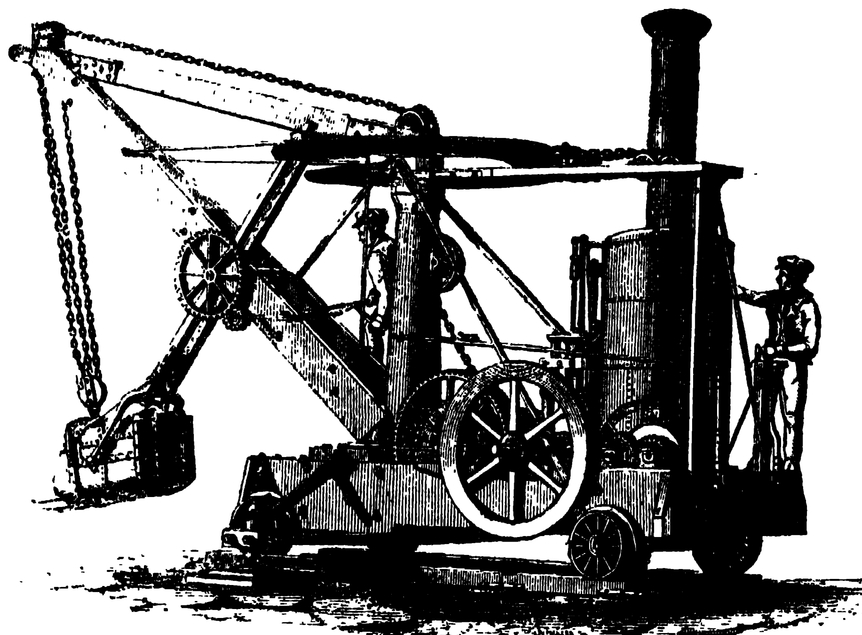
I think sufficient has been said in justification of devoting an entire article to this subject, and I can with a good grace affirm, that little, if any, detail is to be had in any of the works recently published, generalization being the order of the day. How far I have fulfilled my promise of entering on the construction of earth wagons, as noticed at the conclusion of a former paper, I must leave to the readers of the *Journal*. Few persons have had opportunities so extensive perhaps to observe different constructions, as I was engaged on three public lines of railway during their construction, and, besides, visited most of the principal railways when in hand. I have known the faulty construction of wagons make a halfpenny per yard difference

in the price of labour in excavations; and when it is considered that the quantity of excavation on some lines extends to nearly 100,000 yards, the amount then lost was nearly £4000 per mile, or about the whole cost of the permanent way. This I think is sufficient to show that this subject is worthy of attention in all future lines of road.

Now that railways are being made single lines or partly double; points, crossings, and turn-outs, assume a place of greater importance than heretofore, and if you think them worthy of a place, I will endeavour to furnish another paper exclusively devoted to their consideration.

St. Ann's, Newcastle-upon-Tyne. O. T.

THE STEAM EXCAVATING MACHINE.



We have already had the pleasure of introducing this important machine to the public, and we now avail ourselves of the opportunity of giving some further account of it. As is well known, it is of American invention: and this individual machine was imported from the United States, after having been employed on a railway there, for the purpose of testing its capabilities in this country. It is now at work on the Eastern Counties Railway, about 20 miles from London, and is exciting much attention. In its present state, the machine is rather complicated, but it is susceptible of great improvement: and we have no doubt that any machines manufactured in this country will be much simplified. For this purpose it cannot be in better hands, the management of the patent being entrusted to Mr. John Braithwaite, the engineer, whose mechanical attainments are well known to the public, and who is well qualified to turn a machine of this kind to the best account.

We shall now proceed to describe the performance of the engine, having already given its working details, with an engraving in the *Journal*, p. 147, No. 68, to which we must refer our readers. The accompanying engraving is a perspective view of the machine when at work, and it will be seen by it, that one man, the engine tender, stands behind, to regulate the performance of the engine, and another man in front to regulate the motion of the scoops and to turn the jib or crane to the right or left, as may be required. By the aid of this jib the scoop is enabled to take a sweep of 30 ft. and clear away obstructions before it to the height of about 14 feet.

The cubic content of the scoop is 1½ yard, and it lifts about 1¼ cubic yard, two of which is about a wagon load of 2½ cubic yards. If the wagons were brought up as fast as the machine could supply them, it would fill 30 per hour. During the day we inspected the machine, it loaded 26 wagons of 2½ cubic yards each within the hour: and at another performance, it filled 103 cars in 5½ hours. By these trials the duty of the machine appeared to be upon an average 20 wagons or 50 yards per hour, or 500 yards per day. This quantity does not appear to be more than half the duty of the machines as detailed in a report before us, emanating from a committee of managers of the American Institute, New York, especially appointed to examine the machine. The committee state—

"The excavator has been employed for three years upon the Western Railroad and other places, and that this test showed an immense saving of expense. It is calculated to do the work of 150 men, and will fill cars as fast as they can be presented to receive their loads. Allowing for stoppages, one minute may be given as the average for filling a car of 1¼ cubic yard. "The interest for the cost of the machine, wear and tear, men's wages, fuel and oil, 13½ dollars, (about 2*l.* 16*s.*), but to cover the contingencies, say 20 dollars."

There is also another report, showing the daily performance of two machines employed for two months, in almost constant work, at Brooklyn, New York, during which period the two machines worked collectively 881 hours, and excavated and loaded 92,593 cubic yards of earth, equal to 105 cubic yards per hour, or 1080 cubic yards per day. The machines worked during the above period upon an average nearly ten hours per day, which is equal to the working hours of a man. The quantity which one navigator can remove, or "get and fill," in one day, is about 10 cubic yards, or 1 cubic yard per hour; we have, therefore, the performance of one machine equal to 105 men, according to the statements of the American engineers.

We will now proceed to examine the comparative cost of working by the machine and manual labour. For this purpose we must calculate the power of the engine which is called a 10 horse engine, but on account of the high pressure at which the steam is worked, it will be found equal to 34 horse effective piston power. The following are the particulars of the engine:—

Diameter of cylinder 9 inches=63·6 square inches.
Length of stroke, 1 foot; number of strokes per minute, 100 to 110—say 200 feet per minute.
Pressure of steam, 90 to 100 lb. per square inch—say 90 lb.
Fuel—coke.

Then we shall have the engine power $= \frac{63 \cdot 6 \times 200 \times 90}{33,000} = 34 \cdot 7$ horse power on the piston, which if taken in the same proportion as low condensing engines, the nominal power of which is taken at only 7 lb. pressure, or about half the effective piston power, we shall have the nominal power of the engine equal to 17 horses, the consumption of which may be taken at about 10lb. of coal, or 8 lb. of good coke per horse per hour, which will give for the consumption of the above engine $17 \times 8 = 136$ lb. per hour, or 12 cwt. per day of 10 hours. If we take the cost of the coke at 35s. per ton, delivered at the works, we shall have the cost of the fuel 21s., then the cost of working the machine per day may be stated thus:—

	s.	d.
Coke	21	0
Oil, tallow, &c.	2	0
Engine tender	6	0
Man on the stage	5	0
1 labourer assisting	3	6
Sundries	2	0
Cost per day	40	0

This will be the cost for removing 500 cubic yards of earth, but exclusive of repairs, depreciation, interest on cost of machine. The cost of making one of the machines we estimate at 1200*l.* The cost of manual labour may be taken for "getting and filling" (See *Journal* Vol. V., p. 187) at 4½*d.* per cubic yard, then,

500 cubic yards at 4½*d.* = 9*l.* 7*s.* 6*d.*

We have here a difference of 7*l.* 7*s.* 6*d.* between the cost of engine and manual power; and if we make an allowance for the repairs of the machine, depreciation, interest, &c., 2*l.* per day, there will be a saving of 5*l.* 7*s.* 6*d.* We may, therefore, set down the actual cost of engine power at 2*d.* per yard, which would give 1*l.* 3*s.* 4*d.* per day, for 500 yards, thus clearly showing that the steam excavator must ultimately supersede manual labour on account of its cost and rapidity in execution for all extensive cuttings, either for railways, canals, or docks; but if we make our calculations according to the report of the American engineers, allowing the duty of the machine to be 1050 cubic yards per day, the calculation will stand thus:

	£	s.	d.
1050 cubic yards by manual labour at 4½*d.* ..	19	13	
Deduct—Working of engine per day 2*l.* } Repairs, depreciation, interest, &c., 2*l.* } ..	4	0	
Saving	15	13	9

By this calculation the cost of excavation is not quite 1*d.* per yard.

The following testimonials, from engineers in America, will show their opinions of the machine.

Engineer's Office, Western Railroad,
Springfield, October, 9, 1841.

Dear Sir,—In reply to your two letters of the 1st and 22nd September, I have to state, in relation to the Steam Excavator of Carmichael, Fairbanks, and Otis, that it has been most successfully and advantageously in use for the last three years on this road. I have often witnessed its operating in all kinds of excavation, except rock, and in every case I consider it to work to better advantage than men with picks and shovels could. We have experienced great advantage in the expedition with which excavations are made by this machine. Of course, like all other modes of excavation, it will perform the greatest amount of work in a given time in the easiest kind of excavation, that is, in coarse sand; it has removed often as much as one thousand yards per day in such; but I consider it of most importance and advantage in the kinds of excavation where the ordinary modes experience the greatest difficulties, for instance, in stiff clay and in very coarse gravel, where it is difficult to penetrate with the common shovel.

I consider this machine of great value, and it can be used with great advantage whenever the quantity will justify the first cost. It is a simple machine, easily managed, and not costly.

Respectfully, your obedient servant,
George W. Whistler, Engineer, W. R. R.

Springfield, September 6th, 1841.

Dear Sir,—In reply to your letter of the 1st instant, I have to state that the Excavating Machine of Carmichael, Fairbanks, and Otis, has been in use on the Western Railroad upwards of three years. I have witnessed its operations in stiff clay, in compact gravel, mixed with boulders of different sizes, in quick sand, and in common sand and loam. In all these various soils, the machine has worked advantageously, and the most so I consider in the cases which present most difficulty when the ordinary modes of excavation are resorted to—to wit, in the clay and the quick-sand.

I have not at hand the means of stating the amount of material excavated per month in the several soils enumerated, but I recollect that in August 1840, in sand and gravel in the section, it excavated 19,000 cubic yards in twenty-five working-days, and 1000 yards per day were excavated for several days in succession. I consider the machine of great value, susceptible of being applied advantageously wherever earth in any quantity is to be removed, easily kept in repair, and by no means a costly engine.

It is now, as you are aware probably, applied exclusively to work on *terra firma*, but the engine may readily be placed upon a scow, and used with great effect in dredging.

Respectfully,
W. H. Swift.

APPARATUS TO REGULATE THE SUPPLY OF WATER TO BOILERS.

It is becoming a very common practice, and there can be no doubt as to its being attended with great advantage, to use steam of fifteen and twenty pounds pressure per square inch, instead of two and three pounds per inch, as is usual with the Boulton and Watt engines, and to reduce its elastic force, previous to its passing to the condenser, by allowing it to expand within the cylinder. Having lately been called upon to fit an expansive apparatus to an engine of this class, it of course became necessary to make considerable alteration in the apparatus previously employed to regulate the supply of water admitted into the boiler. To effect this alteration in accordance with the principle of the old apparatus, it would require a feed-pipe some thirty feet high, with the usual complement of rods, levers, counterweights, &c., to communicate motion from a float upon the surface of the water within the boiler to a stop-valve at the top of the feed head. This principle is, however, in some instances adhered to, to a very great extent, but in the present it would have created a frightful "monument," too much so to be tolerated by a town which *once* boasted great engineering skill. In order to avoid this, I contrived an apparatus which answers the purpose beautifully, and has such a remarkably simple outward appearance as to induce me to take the liberty of submitting it to the readers of the Journal.

The accompanying engravings consist of two views of my apparatus. Fig. 1 is a side elevation, and fig. 2, a vertical section. The parts distinguished by letters are as follows:—T, the top of the boiler; W, the water level; V, the valve-chest, cast on the end of the pipe P; C, a compensation valve; F, a float, encircling the pipe P (made of sheet copper); R, three small rods descending from the float to the three ends of the crossbar B, which are shown flatwise in fig. 3; E, the pipe to convey water from the feed-pump; S, a small rod for connecting the valve C with the crossbar B; D, a door, fixed by four screws to the side of the chest, which may be readily removed in case of examining the valve.

With this simple arrangement, it will be observed, there is not a packed joint of any kind through which the steam can escape, and here we get rid of that very common and disagreeable hissing of the

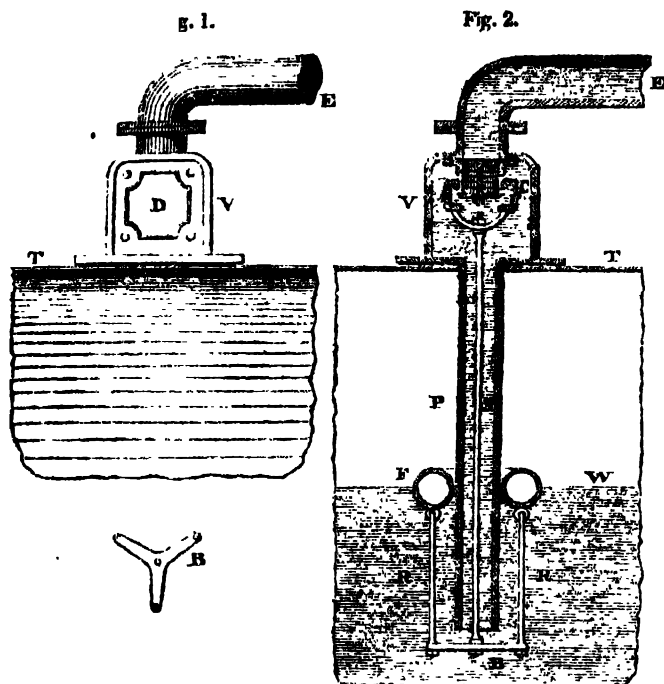


Fig. 3.

steam from around the float-wire, &c., the effect of which always proves so injurious to the boiler.

The compensation-valve, I presume, will be too readily understood to need any explanation from me; it may, however, be noticed, that it is composed of brass, and that the part which is attached to the float, as well as the other part, is cast is two pieces, as may be distinguished by the section-lines in fig. 2—this is essential to the putting of the valve together. It may be further observed, that, to avoid any alteration in the original feed-pump, a spring-valve is introduced in a convenient part of the pipe adjoining to E, just sufficient to allow the surplus water to make its escape without subjecting the plunger to any additional strain.

VESPER.

Leeds, July 1, 1843.

GRESHAM COLLEGE.

(With an Engraving, Plate XI.)

THE widened line of communication from the Post Office to Lothbury and the Bank is an improvement that was greatly needed, for it used before to be not only most inconveniently but dangerously narrow in many parts, and those where there was the greatest traffic of all. Nor has the improvement which has taken place in that respect been unattended with considerable improvement in regard to architectural appearance, both as regards the elevations of the houses generally, and one or two designs in particular. Of these last, the chief is "Gresham College," which stands at the corner of Cateaton and Basinghall streets, and which, if we are rightly informed, is now to give its own name to the first of them, it being intended to be called Gresham Street. This building was erected from the design of Mr. George Smith, architect to the Mercers' Company, at whose expense the building is erected. The elevation, represented in our engraving, is that of the entrance front towards Basinghall Street, and is a more than ordinarily dignified composition, and of marked monumental character. Besides that the order itself is upon an ample scale, (the height of the columns being rather more than 35 feet,) it displays itself to very great advantage, owing to there being no windows, nor any other aperture than the entrance door; consequently there is great repose and breadth of surface, besides a decidedly peculiar character, of which we have so very few instances even among our public buildings—which do not always show with the happiest effect the orders applied to them—that it amounts almost to a novelty. It is here too, a greater merit than it ought to be, that the order is treated consistently—that, instead of being at all neglected, the entablature is well finished up with carved mouldings to its architrave, and the cornice itself made unusually bold and rich, so as to be a striking feature in the whole composition, and give decided expression to that important part of an elevation: and if it may seem exaggerated in its proportions and enrichments, to those who are accustomed to the meagre and shelf-like things usually put as the finishing of an Ionic or Corinthian entablature, even excess in this respect is far less reprehensible than the opposite fault of deficiency. We do not say, that as the columns are unfluted, too much embellishment is put into the cornices, because a cornice equally rich might be applied where there are no columns at all; still we are of opinion, that had, in this instance, the three-quarter columns been fluted, they would have been better relieved against the plain wall, and there would also have been a pleasing degree of variety arising from the contrast between them and the angle pilasters.

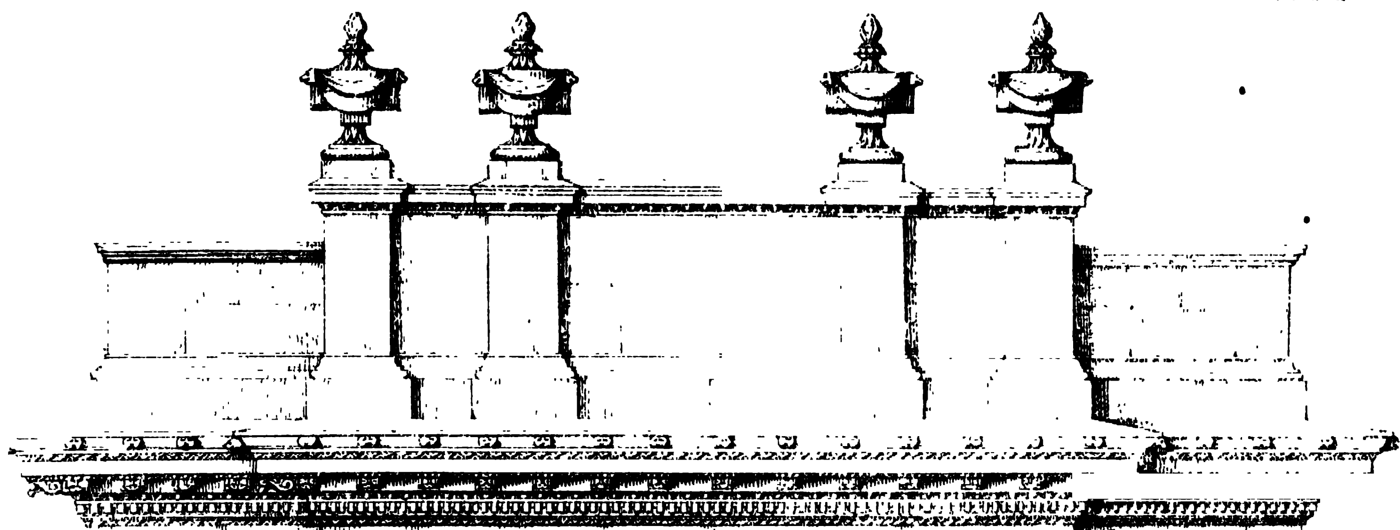
Such further degree of decoration was all the more desirable, because owing to the aspect of this front—which is that facing the east, the effect of boldly defined light and shade, which it would else have, is nearly lost. Much, therefore, is it to be regretted that this elevation could not be adopted for the south one, in which case it would have had the further advantage of being towards the wider of the two streets—and it evidently shows itself to be properly the *front* and not the *side* of the edifice. At present the side which is now made the front, looks too secondary in importance to the other, and as seen at the same time with it in an angular view of the building, not sufficiently of the same character, for while the east elevation is nearly solid, the south one is—we were going to say—full of windows; and so, indeed, it is in one sense, because, though there are only six windows in all, viz., three on a line on each floor, they fill up the design too much, the extent of frontage being only 37 feet, which was not sufficient to allow of such breadth for the piers as would have produced a character of solidity, in keeping with that of the entrance front.

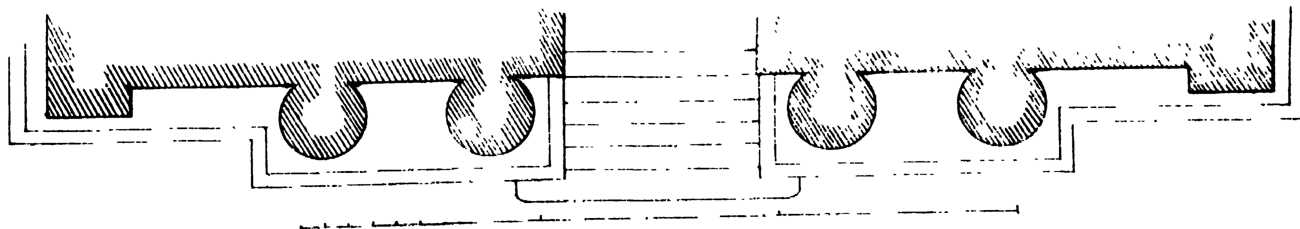
It could further be wished that the windows themselves were more alike as to style, for the three lower ones, which are arched segmentally, and have "kneed" architraves, do not very well accord in character either with those above them, or with the rest of the design. The upper windows have slightly projecting stone balconies before them, and full entablature dressings, which do not leave sufficient space between them and the general entablature of the order; and unless these windows could have been kept from rising higher than the lower line of the pilaster capitals, that inconvenience might have been in some degree obviated, by giving the pilasters themselves only shallow antæ-caps.

The interior is devoted to the purpose of lecturing; the upper story contains a well arranged but small theatre, and the ground-floor contains private rooms for the professors, entrance hall, and a noble staircase.

THE GREENWICH PIER.—The lawsuit between the stone pier company and Messrs. Grissell and Peto, the contractors, has been stayed by proceedings in Chancery. Messrs. Grissell and Co. have obtained an injunction; the case has been referred to eminent counsel, and an amicable arrangement entered into for both parties to bear an equal proportion of the expense to be incurred in putting the permanent pier into really substantial condition. It is stated that to do so at least 17,000*l*. must be expended. The pier company are driving a number of piles close to and alongside the watermen's floating pier, and are determined to drive them away from their position.—*Times.*

PLATE VI





A NEW AND SIMPLE METHOD TO FIND THE PERPENDICULAR HEIGHT OF MOUNTAINS, HEADLANDS, &c. ABOVE ANY GIVEN DATUM, FROM BAROMETRICAL AND THERMOMETRICAL OBSERVATIONS.

By OLIVER BYRNE, Mathematician, Author of "The Doctrine of Proportion," &c.

RULE.—Add the allowance found in Table I for the difference of temperature taken by the attached thermometer, to the logarithm of that height of the barometer which corresponds to the least degree of the thermometer. Then to the logarithm of the difference of the logarithms of the heights of the barometer observed at the higher and lower stations, thus corrected, add the logarithm of the allowance found in Table II, for the mean temperature of the detached thermometer when increased by the constant number ·92102; this sum will be the logarithm of the required height in fathoms. Observe: the first four figures of the logarithms of the heights of the barometer, together with the indices, are to be counted whole numbers, and the numbers taken from Tables I and II must always have five places of decimals, though they need not always be used. Tables I and II may be dispensed with, as ·456789 answers to a degree of the attached thermometer in Table I, and ·0024680 to a degree of the detached, in Table II.

Previous to M. De Luc commencing his experiments on the barometer, it was considered that a mean between the two temperatures shown by the thermometer attached and the height of the mercury in the barometer at two different stations, was sufficient to determine the perpendicular distance of those stations. But De Luc found, by repeated experiments, that an additional or detached thermometer was likewise necessary, which has since been confirmed by General Roy, Sir G. Shuckburgh, and others.

However, before making further remarks, we shall illustrate the rule just given by practical examples.

TABLE I.

Of the allowance for the difference of the temperatures of the attached thermometer.

	Tens, Units, Tenths
1	0 1 567 8 9
2	0 9 135 7 8
3	1 3 703 6 7
4	1 8 271 5 6
5	2 2 839 4 5
6	2 7 407 3 4
7	3 1 975 2 3
8	3 543 1 2
9	4 1 111 0 1

TABLE II.

Of the allowances for the mean temperatures of the detached thermometer.

	Hundreds, Tens, Units, Tenths
1	0 0 0 24 6 8 0
2	0 0 0 49 3 6 0
3	0 0 0 74 0 4 0
4	0 0 0 98 7 2 0
5	0 0 1 23 4 0 0
6	0 0 1 48 0 8 0
7	0 0 1 72 7 6 0
8	0 0 1 97 4 4 0
9	0 0 2 22 1 2 0

Examples.

1. The heights of the barometer at the bottom and top of a hill are 29·862 and 26·137 inches; the attached thermometer at the bottom and top indicates 68° and 63°; also, the detached thermometer at these stations gives 71° and 55° respectively. It is required to find the perpendicular height of the mountain.

Thermometer attached.			*Thermometer detached.*		
Lower station	..	68	Lower station	..	71°
Higher "	.	63	Higher "	..	55
					2) 126
Difference		5	Mean		63

Barometer at summit, where attached thermometer indicates least degree } 26·137, log. = 14172·557
From Table I for 5 units we have 2·28394

Log. corrected 14174·84094

Barometer at base = 29·862, log. 14751·189
Take 14174·84094

Log. 576·34806 = 2·7606848

Then, from Table II, for 6 tens ·14808
For 3 units (making in all 63) ·00740
Constant ·92102

Log. 1·07650 = 0·0320140

Height in fathoms = 620·4385, corresponding to log. 2·7926988

II. Wishing to know the perpendicular height of the mountain Chraughaun, in the county Wicklow, and having two barometers and detached thermometers which for months before agreed with each other in different states of the air, leaving an assistant on a level with the sea near Arklow, with directions to make accurate observations every fifteen minutes from 3 to 4 o'clock (our watches being previously regulated) I proceeded to the top of the mountain, and at the appointed hour commenced observations. The mean result of the five were as follows:—the barometer stood at the summit 28·635, and at the base 30·609 inches; attached thermometer, 61° and 65·5,° and detached thermometer 54·5° and 70°, respectively. It is required from these data to find the height of the eminence.

Thermometer attached.			*Thermometer detached.*		
Lower station	..	65·5	Lower station		70°
Upper "	..	61·0	Upper "	..	54·5
Difference		4·5			2) 124·5
			Mean		62·25

Barometer at summit, where attached thermometer is least } = 28·635, log. 11568·972
For 4 units, from Table I, we have 1·82715
For 5 tenths ·22839

Log. corrected for temperature 11571·02754

Barometer at summit, where the attached thermometer is least } 11858·491
Subtract 11571·02754

Log. of 287·16346 = 2·4585880

From Table II we have,
For 6 tens = ·14808
For 2 units = ·00494
For 2 tenths = ·00049
For 5 hundredths = ·00012 } making up 62·25
Constant =

Log. of = 0·0312671

Hence the height in fathoms = 308·923, log. 2·1898551

It may be observed, that this experiment was repeated at different times, and consequently in various atmospheres, yet the result never varied two feet. We may, therefore, conclude that the highest summit of the Wicklow mountains is very nearly 1853 feet above the level of the sea.

This rule will be found to give results more accurate than either that of General Roy or of Sir G. Shuckburgh, and can be applied with greater ease.

General Roy makes the height in fathoms = $(10000\, l \mp \cdot 463\, d) \times (1 + [f - 32]\, \cdot 00245)$.

Sir G. Shuckburgh makes it,
$(10000\, l \mp \cdot 440\, d) \times (1 + [f - 32]\, \cdot 00243)$ fathoms; where l = the difference of the logs. of the heights of the barometer at the two

stations; d = the difference of the degrees shown by Fahrenheit's thermometer attached to the barometer; f = the mean of the two temperatures shown by the detached thermometers exposed for a few minutes to the open air in the shade, at the two stations. The sign *minus* takes place when the attached thermometer is highest at the lower station, and the sign *plus* when it is lowest at that station. 10000 (log. m — log. M) was the expression formerly given to find the altitude in fathoms, m M being the heights of the mercury at the base and summit of any eminence. This formula is very easily applied, and not far from the truth when an allowance is made for the increase of temperature above 31°, for this is the degree of temperature to which the above formula is calculated, or rather adopted. As air expands very nearly $\frac{1}{435}$ part of its bulk with every degree of heat, and suffers the same contraction with every degree of cold, the following rule was usually given. *Rule.*—Observe the height of the mercury at the bottom of the object to be measured, and again at the top, as also the degree of the thermometer at both these situations, and half the sum of these two last may be accounted the mean temperature. Then multiply the difference of the logs. of the two heights of the barometer by 10000, and correct the result by adding or subtracting so many times its 435th part as the degrees of the mean temperature are more or less than 31; the last number will be the altitude in fathoms.

We are too apt to say, when two or more phenomena happen together, that one is caused by the other: where all may be governed by some unknown phenomena. The writer of this article agrees with Mr. Pasley, that the philosophy is false which teaches that expansion is caused by heat, for without fire or heat water is expanded as it becomes ice, and air in the air pump vacuum; solids require fire as a means, but the expanding cause itself is perfectly distinct from fire. However, when experiments show that certain phenomena increase and decrease together, one may be taken as an index, if not as a function of the other; but great care ought to be taken not to draw general inferences from limited experiments. At some future time we shall explain why the attached and detached thermometers differ, and also show how they may be made to agree, and at present proceed to the more immediate object of the communication. To illustrate the rule just given, we shall add another example.

III. If the heights of the barometer at the bottom and top of a hill are 29·37 and 26·59 inches respectively, and the mean temperature 26°, what is the height?

Log. 29·37 = 1·4679039
Log. 26·59 = 1·4247183

·0431856 × 10000 = 431·856. Then 31° − 26 = 5 degrees, therefore by the rule, 431·856 − 431·856 × [illegible] = 431·856 — 4·964 = 426·892 = the height in fathoms.

We shall now investigate the last formula, and give an outline of the theory upon which this proposition is founded. Let E A R represent part of the surface of the earth, and A T a column of the atmosphere. Conceive this column to be divided into a number of equal and infinitely small parts, as AB, BC, CD, &c., in each of which we may suppose the density to be uniform, because they are infinitely small. Now since the density [of] the air is always directly as the compressing force, therefore we h[ave] the density of the air in any of the portions AB, BC, &c., as the weight of the column of the atmosphere above that place; that is, if P represents generally the pressure, D the density of any place, P′ the pressure at any other place, and D′ its corresponding density, we shall have P : P′ : : D : D′; that is, the pressure is to the density in a constant ratio, and may be represented by n to 1; therefore, P : D : : P′ : D′ : : n : 1, consequently abstractedly speaking,

$$D = \frac{1}{n} P,$$

$$D' = \frac{1}{n} P',$$

$$D'' = \frac{1}{n} P'', \&c.$$

That is, the density at any place is equal to, or rather may be measured by, the nth of the pressure of the column of the atmosphere above that place, or by the nth of the compressing force. Hence if we make P stand for the pressure at the surface A, and let each of the parts AB, BC, CD, &c., be equal to 1, then will $\frac{1}{n}$ P represent the weight or pressure of the part AB, and therefore,

$P - \frac{1}{n} P = \frac{n-1}{n} P$ = the pressure at B, and $\frac{n-1}{n^2} P$ = the density or weight of BC. In the same way,

$\frac{(n-1)^2}{n^2} P$ = the pressure at C, $\frac{(n-1)^3}{n^3} P$ = the pressure at D, &c.

So that the pressure, and consequently the density, will decrease in a geometrical progression, as the altitudes increase in an arithmetical progression. Calling the density at the surface d^n, and the several altitudes 1, 2, 3, 4, &c. we shall have the following corresponding series:

Altitud ..	0,	1,	2,	3, &c.
Corresponding densities	d^n	d^{n-1}	d^{n-2}	d^{n-3}, &c.

Dividing the latter series by d^n we have,

Altitudes ..	0,	1,	2,	3,	4, &c.
Corresg. densities	1	d^{-1}	d^{-2}	d^{-3}	d^{-4}, &c.

This is strictly analogous to the property of logarithms. In fact the several altitudes form a peculiar system of logarithms of which the reciprocals of the corresponding densities are the natural numbers: from this circumstance they have been denominated atmospheric logarithms. From a similar circumstance the Napierian are termed hyperbolic logarithms, because they express the areas contained between the asyptotle and curve of an hyperbola. We shall write these atmospheric logarithms with large letters, thus, "Log," to distinguish them from the Briggean or common logarithms, which are written "log. $_{10}$," or simply "log." and also from the hyperbolic or Naperian which are denoted by "log. $_n$." Let A, a, represent any two altitudes, and D, d, their corresponding densities, then will A = — Log. D, and a = — Log. d,

$$\therefore A - a = \text{Log. } d - \text{Log. D} = \text{Log. } \frac{d}{D}.$$

Now it is a well known property in logarithms, that by assuming different values for the base, there will be as many different systems of logarithms; and it is equally well known, that in all the various systems of logarithms, the logarithms of the same numbers can be converted from one system to another, by a constant multiplier or modulus. The object of our present inquiry is to determine a constant multiplier that shall convert the common logarithm of a number into the atmospheric logarithm of the same number. To accomplish this, let

$$\text{Log. } \frac{d}{D} = x \log. \frac{d}{D},$$

$$\therefore A - a = x \log. \frac{d}{D},$$

Then making $a = o$, or which is the same, if we suppose d to represent the density of the atmosphere at the surface of the earth, we shall have $A = x \log. \frac{d}{D}$.

In order to find x let us take the height of a homogeneous atmosphere, when the temperature shown by the thermometer is 31°, and the height of the barometer 29½ inches at 26057 feet; then the density at the surface, and one foot above it, will be

$$a = o; \quad d = 26057.$$
$$A = 1; \quad D = 26056.$$

That is, the pressure at the surface will be equal to a column of air of uniform density 26057 feet high; and consequently one foot above the surface = 26056 feet high, or a foot less. Since the densities are as the pressures, we have

$$A - a = 1 = x \log. \frac{26057}{26056};$$

making $26057 = n$, we have $1 = x \log \frac{n}{n-1}$

$$\text{but } \log. \frac{n}{n-1} = M \left(\frac{1}{n} + \frac{1}{2n^2} + \frac{1}{3n^3} + \frac{1}{4n^4} \text{ \&c.}\right)$$

And when, as in the present case, n is a large number, all the terms but the first may be neglected as unimportant; also, since M = ·43429448, the modulus of decimal or common logarithms,

$$\therefore 1 = x \times \frac{\cdot 43429448}{26057}.$$

whence $x = \frac{26057}{\cdot 43429448} = 60000$, very nearly, or x may be readily found from the expression $x = \frac{1}{\log. \frac{n}{n-1}}$

The above formula is reduced to

$$A = 60000 \log. \frac{d}{D} \text{ feet};$$

or putting m and M the heights of the mercury at the earth's surface and at the altitude A, then the fraction

$$\frac{d}{D} = \frac{m}{M}$$

Also since 6 feet are equal to one fathom, the simple multiplier 60000 for feet becomes 10000 for fathoms, which is more convenient. Hence instead of

$$A = 60000 \log. \frac{d}{D} \text{ feet}$$

$$\text{We have } A = 10000 \log. \frac{m}{M} \text{ fathoms,}$$

which is the formula formerly used in measuring altitudes by the barometer.

With respect to the height taken for the homogeneous columns of air different writers vary, but this difference does not affect the ultimate result. It is well established, that the height of an homogeneous atmosphere, whose density would be equal to that of the air at the earth's surface, and weight the same as that of the real atmosphere when compared with a column of mercury or other fluid of the same weight, the heights will be reciprocally as the specific gravities of the air and mercury or other fluid. So that if we take the specific gravity of the air at the earth's surface at $1\frac{1}{5}$, when compared with distilled water at 1000, and that of mercury 14000, also the column of mercury in the barometer = $29\frac{1}{2}$ inches, we have $1\frac{1}{5}$: 14000 : : $29\frac{1}{2}$: 344166 inches = 28680·5 feet = 5·43 miles. But the specific gravity of fluids varies as their temperatures vary. It has been found by various experiments, that when the mercury in the barometer stands at 30 inches, and the thermometer at 55°, the specific gravity of air, water and mercury are nearly as $1\frac{1}{5}$, 1000 and 13600. Hence $1\frac{1}{5}$: 13600 : : 30 : 340000 inches = $28333\frac{1}{3}$ feet = 5·366 miles, the height of a homogeneous atmosphere. Again, taking the specific gravity of the air at the earth's surface at $\frac{5}{6}$, which some affirm, and the barometer at $29\frac{1}{2}$ inches, it will be $1\frac{5}{6}$: 13600 : : $29\frac{1}{2}$: 328255 inches = 27318 feet = 5·1814 miles. Hence, generally, we may assume if the air was of the same density at all altitudes as at the earth's surface, its height would be between five and six miles. But it matters not what degree of temperature we assume, for we can always accommodate the result to any other temperature, as before observed, by augmenting or diminishing the result by the $\frac{1}{435}$th part for every degree above or below 31°.

It may further be observed, that the common barometer, with some trifling alterations, of which we shall speak hereafter, is the best and most to be depended on; for many which are said to be improved have only the recommendation of deviating from it in simplicity. It appears from accurate observations, that mercury stands higher in tubes of larger than in those of narrower bore; and therefore, when observations are made with different barometers, attention should be paid to the difference of their diameters. In order to prevent the effects of the attraction of cohesion, the bore of the tube should not be less than one fourth of an inch; but one third of an inch would be better.

Note.—Further particulars relative to this important subject is given in a work about to be published, entitled "A New Theory of the Heavens and Earth."

OBSERVATIONS ON THE CONSTRUCTION OF ROADS THROUGH BOG.

The bogs in Ireland form a vast extent of surface, which for the most part, is profitless, save for fuel, but a large portion of which is capable of being converted at a small expense into good arable land, which would yield an average crop: but the absence of roads in these extensive wastes, has prevented the capital of individuals from being profitably invested, in the reclamation of those barren plains, now tenanted by the plover and the snipe.

It seems to have been the system with engineers of former days, to avoid by every means the construction of a road across bog, and accordingly they have not scrupled, by a very circuitous route, greatly to extend the distance between the termini in preference to encountering the unstable foundation of a bog, which the science of road-making has, in latter years, rendered a comparatively easy and safe undertaking. Still, even in modern works, it is to be regretted that so frequently is to be seen a road, otherwise well selected and judiciously laid out, materially injured by deviating from its proper course, in order to avoid an intervening bog; and as the engineer, in tracing a line of public road, should ever bear in mind that the chief advantages of communication is to open the country, and to afford every facility for improving and drawing out the resources of those lands, whose capabilities have been suffered to lie dormant for want of this advantage, the intersection of bogs by roads should therefore not be avoided.

The most favourable months in the year for commencing operations in the construction of bog roads, are June, July, August and September (if dry), since at those periods the surface is more free from water, and consequently the bog more firm than in the rainy months; and it is of the greatest importance to have fine weather for these works.

When a line of road passes over a shallow bog of from three to four feet in depth, with a firm and compact substratum, and when soling material could not be procured without the expense of land damage, and the cost of carriage should be great, or when the soling should be of an inferior or unsuitable quality, it will be most advantageous (provided the gradients will admit) to remove the bog mould altogether, to form the road upon the hard bottom, and to sink the grips sufficiently deep to prevent the moisture of the adjacent bog producing injurious consequences.

In the construction of a road over the surface of a bog, the first point to be attended to, and which is of the chief importance, is the thorough drainage of that portion of the bog upon which it is determined to place the road materials. When the line is lockspitted, a grip is to be cut on both sides of the road of sufficient capacity to command the complete drainage of the surface; and in soft bog, a second grip should be cut on both sides, at about 10 feet distance from the first; and it will be particularly necessary that great attention should be observed in keeping them free from impediments, and that there should be no obstruction to the free passage of the water. The second grip, in addition to the greater facility of drainage, will be

found useful as a protection against persons cutting turf up to the very road fence, and in a short time, leaving the road (as is frequently the case) an embankment dangerous for travelling on, and liable to slip. The surface water should then be tapped off by means of mitre drains judiciously placed, and when the whole is perfectly free from water, the inequalities of the surface should be reduced by filling the hollows with heaty sods, and the formation conducted in the usual manner for roads upon ordinary upland ground, but it will be judicious to give the cross section greater convexity to allow for compression.

The laying on of the soling is the next operation to be attended to; and as to the period for undertaking this work, I must differ in opinion from many engineers, who strenuously insist that the soling should not be laid on, until one, and in some cases two seasons, after the grips have been opened. I would recommend, that when the surface of the intended road had been freed from water, by the means before mentioned, that the soling should be immediately put on, as the superincumbent weight will compress the bog, and thereby accelerate the process of drainage, and also protect it from the frequent saturations with rain, to which it would otherwise be subject, as by the formation all the surface water must fall off into the grips.

This opinion, which I now venture, is founded upon practical observation. About three years ago, when superintending the execution of a long line of road in the south of Ireland, under the direction of the Board of Works, which for about six miles was carried across bog of various depths, a portion of it was solid immediately after being drained, and a portion after the drains had been opened and the surface formed was left unsoled, in consequence of the winter setting in: in the following summer, when proceeding to complete the operations in the bog, I found that part which had been soled was firm and well consolidated, and in excellent condition for receiving the metalling, while that portion which had been unsoled, was in a much worse and softer state than the adjacent bog, especially where the surface had been cut for the purpose of reducing the inequality.

As the durability of a road will depend in a very great measure upon the soling, the quality of the material to be used for this purpose, is of great importance. Vegetable earth is certainly bad, and if, in the absence of better material, made use of, cartage should not be permitted upon it until after the metalling had been laid on. A compound of stiff clay and sharp sand, mixed naturally, constitutes an excellent soling substance, as it will form a tenacious unyielding crust, which will not be liable either to wash away or sink into the bog. This substance is frequently found under bog, and in such cases, will be the best which can be used, and the most economical. Seven inches in depth of soling will be sufficient for country roads where the traffic is not very great.

After the soling has been laid on and the compression and drainage completed, the fences should be made in the usual manner, with pipes or outlets underneath, to convey the water from the water-tables into the grips. Road contractors generally construct the fences, when cutting the grips, with the sods and turf mould which is raised therefrom; but this is both an incorrect practice and false economy, as the subsidence and compression of the bog will cause the fences to form a waving line, instead of the direction first laid out, and the weight of the soling will generally cause the surface between the fences to spread out, and then a larger area than required must be covered over with metalling, which will greatly increase the expense. In a bog road in the county of Kerry, fenced at the time of sinking the grips, and laid out 21 feet wide between the fences, I found, after the soling had been laid on and consolidated, and when about to spread the broken stones, that the width between the fences measured 23 feet. In this case there was a decided loss to the contractor, as he was obliged to cover with metalling the entire surface of the road, to within 18 inches of the water tables on each side.

The stoning and blinding is conducted in the same manner as in ordinary roads.

When a road is to be formed on an embankment over bog, the base of the embankment should be very wide, in order to extend the superincumbent weight over a large surface, and the sides should slope 2 feet horizontal to 1 foot perpendicular. The irregularities of the surface, upon which the embankment is to be raised, should be reduced, and then covered over with regular courses of dry heathy sods, with the heathy side placed downward, but the top course should be laid with the heathy side upward. When the embankment has been raised to the required height, the road should be formed solid, faced and stoned as before described. In a soft and yielding deep bog, the sods for the embankment should not be cut from that portion of the bog adjoining the road, or the embankment may subside very much, and cause the adjacent surface, from which the sods have been cut, to elevate.

I have seen the injurious consequences of this practice exemplified in many cases, but in two in perticular: in the first, the embankment subsided very much, and the gradients were completely altered, the longitudinal section of the road forming a waving line: in the second case, a gullet constructed about the centre of the embankment, sunk beneath the level of the bog, before the embankment was completed, and the adjacent surface was elevated; a second gullet was built over it, and also disappeared, and a third gullet was built over the second, after the necessary precautions had been taken, and the embankment has since remained firm.

In constructing a road in cutting in bog, after the stuff has been excavated, the surface should be covered with one or more courses of bog sods, and then formed, soled, fenced, and stoned in the usual manner, having previously paid due attention to the drainage.

F. V. C——, A.B., C.E.

Dublin, 6th July, 1843.

THE CARTOONS—1819, 1843.

It is exactly nine and thirty years ago, when a youth named Henry Ardor was waiting for the mail, which was to carry him from his father's roof and his mother's affections, to London, to try his fate as an historical painter, that an old friend of the family, a very wise and worthy man, and brother of Northcote the painter, came to bid this youth farewell. "Ah, it will never do," said his father. "I hope it will," sobbed his mother. "I am determined it shall," said the youth. His venerable friend shook his hand, and said, "Be sure, my dear young friend, you begin with the skeleton, and study hands and feet, for there is not a painter in London who understands a hand or a foot.[1]

The horn was heard, now dying away, now bursting out as it turned the corner of the street in full view, and the horses were seen, trampling and curbed, the royal coachman, with his white hat and scarlet coat, and the guard, red-faced and important, drove up like lightning, and drew up in style. The youth kissed his sobbing mother: "God bless you," echoed from all the assembled friends in a country town, the door drove home with a slam, the horn again blew, and away rattled Henry Ardor, wrenching his affections, with a spasm that squeezed the burning tears out of his eyes, which scalded his cheeks as they fell.

His love of art was a passion of his being, and had been from his earliest infancy: he had often ridiculed in his native town the tip-toed absurdities of the old portrait school, and had often been corrected by his father for presumption; he had made up his mind to devote himself, with all his heart and all his soul, to reform the design of his country, by mastering the construction of the figure, to take pupils as soon as he was qualified, and if talented, to spread the sound doctrine of beginning with the skeleton, and enforcing that as the basis. He entered London, May 14, 1804, and overwhelmed with the intensity of his great object, he went to the new church in the Strand, and falling on his knees, prayed God for success only in proportion as he deserved it. Remembering the warning of his worthy friend, his application was incessant, so that in two years he produced works which honoured his name; he had been admitted a student at once in the Academy, and greatly benefitted by that excellent school, and such a cluster of genius was admitted at the same time, that the men of that period have been the support and the reformers of the art ever since. Such was his obedience

[1] What would he say now?

and his diligence, that he deservedly earned the affection and the respect of all his superiors, and all his superiors lauded him as an example to all other young men. Now though there were and had been eminent men, West, Hussey, Barry and Fuseli, not one of them had so deeply and scientifically mastered the figure, and at that time, 1805, though there always had been lectures on anatomy, the skeleton had never been in the antique, and it was from the repeated entreaties of young Ardor, and his fellow students, and the keeper's repeated remonstrances to the council, that the council at last wisely yielded to the wish.

Ardor soon got into high life, and was the wonder of its coteries—went to four routs of a night—was told by the women he had an antique head, and lay in bed late next day; but finding this species of fascination not conducive to application, by degrees he weaned himself from its fascinating attractions—though if he had waited a year, he would have been utterly forgotten, and "left alone in his glory," as hundreds of Ardors had been before, and will be again whilst that delightful class pursue novelty in preference to excellence. Such was the repute Ardor got in his native town, that a boy named Caution was rouzed to come up: up he came too, drank tea with Ardor, and went away so fired by Ardor's enthusiasm, that the next day he called and said, "I'll be a painter, Ardor."

Ardor loved his art better than himself always, and said, "Caution, if you will, I'll tell you all I know." Caution put himself at once under Ardor. Ardor lent him a plaister hand, his anatomical drawings, admitted him at all hours, made him his friend, his pupil, his companion, and poured forth all he had got himself by hard work: as Ardor said, "If I can advance the art, and reform design, my end will be answered." Caution was a good and moral youth, and was very grateful, and so were Caution's friends. Caution went to Italy, and found all the principles Ardor had taught him of the greatest utility in comprehending the great works he saw. In the mean time Ardor took other pupils, and made them go through the same course: and thought it a good plan if two cartoons could be got up from Hampton Court at the Gallery for the use of his pupils. An influential friend approved of the plan, applied to Lord Farnborough and the late Duke of Sutherland, who in an audience of the King, got leave: and Mr. West was ordered to see two cartoons moved up, as keeper of his Majesty's pictures: and St. Paul at Athens, and the boats, were those Mr. West chose.

The moment the cartoons came to the gallery, Ardor sent in all his pupils, who made chalk cartoons the full size, and such was their excellence, and such their impression in the town, that the crowd was obliged to be stopped, and the doors shut, to prevent injury to Raffael's works. Ardor on this moved the cartoons of his pupils to St. James's Street—gave a splendid private day to the nobility—the Arch-Duke Maximilian came with Lord Aberdeen—all the women of fashion praised Ardor more than ever, and Ardor and his pupils became the fashion of the day, and it was said nothing could stop Ardor's career. Unfortunately Ardor had got very angry with the Royal Academy, where he had educated himself, and shared its favours, and Ardor in his fury against the members of that body, had so provoked them by the truth and exposure of their abuses, that they one and all put their powerful influence against Ardor's attempt to found a school, and they denied Ardor had any merit at all—they abused his pupils—drove Ardor to ruin, and involved two of his pupils in equal ruin with himself. People of fashion did not know why Ardor was so abused, but concluded forty men must be right, and Ardor deserved it; and so they let Ardor alone and forgot his works, and Ardor was four times ruined and four times again on the field, so that at last it was considered, to ruin Ardor, was a folly. During all this time Caution had been in Rome, and having been severely bitten by Germans, who dressed like Raphael, returned to England, with a resolution to bite his old master, and all his friends too; but he found Ardor so high in the public feeling, and so inveterate in sound art, that there was no introducing the new insanity but by biting or burking Ardor, and it was therefore agreed, between Caution and Namby Pamby his friend, that Ardor must be burked as he would not be bitten.

It must be told, that one night in 1812, Ardor was in the house of Lords, and when Lord Wellesley was speaking, he put himself in the attitude of St. Paul at Athens; Ardor thought of the cartoons and of the Vatican, and he looked up and saw the Spanish armada. Ardor directly planned the decoration of the old house, laid a plan before the ministers, petitioned both houses, never ceased persecuting all the authorities—the old house was burnt down—Ardor petitioned for the new, till at last it was resolved the new houses should be adorned—a Commission was formed, Caution became secretary, as he deserved, Namby Pamby gave lectures, and the plan of burking was immediately put in practice, for in the lectures of the one or the reports of the other, Ardor was entirely extinguished. Now this was very hard, for Ardor had fought the battle, when Caution and Namby ran away, and the people said it was a great shame to burke Ardor, whatever might have been Ardor's enthusiasm; but Caution had a great game to play, and as Caution knew the safest game to play is always to go with the current, and Ardor's love of truth being obnoxious to all, Caution burked Ardor as well as his works. In the mean time some people wanted the Germans, as the English could not draw—Ardor opposed it, and these people said, as *they can't draw*, let us make them compete in cartoons! *then* we know they will fail, and *then* no one can object to the Germans coming, who *can* draw. The plan was eagerly seized, cartoons were prepared, the youth of England were suddenly called from their daily habits of getting their daily bread, and the following year produced works, which astonished their enemies, delighted their friends, and settled for ever the question of their genius. Ardor was so delighted to see the realization of all his struggles, this confirmation of the plan he had successfully began twenty-four years before, that he died of joy in the 57th year of his age, and fell a victim to the danger of telling truth to power, under whatever circumstances of provocation.—Hail and farewell to him.

I had a great regard for him, and was very sorry, so I wrote his epitaph out of regard to his memory, but before he died I am happy to say he had completed his remarks on the cartoon exhibition, as well as some valuable observations on fresco and design, which shall appear now or hereafter, as it suits.

EPITAPH.

Here lies the body of

HENRY ARDOR,

An English Historical Painter,

Who died in the midst of a desperate struggle to make Sovereign, Legislature and People do their duty to the higher walks of design.

"—active and nervous was his gait,
And his whole body breathed intelligence."

WORDSWORTH.

This little romantic history of Henry Ardor was absolutely necessary before proceeding to lay before your readers his remarks on the cartoon exhibition—1st. As to the degree of hope cartoons are justified in generating; 2nd. As to the degree of merit the present exhibition exhibits; 3rd. As to the question of oil or fresco for the houses; 4th. As to what is the style to be chosen either in fresco or oil, and 5th. On the danger of delaying much longer a decided plan of decoration.

1st. As to merit:—

Could the Germans at such a sudden call for specimens of colour, and light, and shadow, and surface, have answered as we have answered this; the one is no more unjust than the other—the Germans know no more of colour, and light, and shadow, and handling, than the English were supposed to know of form. could the Germans have answered the call of colour as the English have answered this?—I reply in a voice of thunder,[2] No! nor any other nation on earth! This, then, is a glory, in spite of the solemn inanities of a timid press!—this is a glory you have achieved, young men, by your own innate bottom. The Rout of Comus (63): Alfred in the Camp; the Death of Lear; St. Augustine: the Skirmish of the Picts; the Plague (136); the Caractacus (84); the Una and Satyrs (10): the Constance: the First Jury; Alfred and the Witan: the Curse (33); and Edward & John (118) entering London, through Southampton, would honour any school in any cartoon contest, in any city in Europe: yet cartoons are a delusive fascination, hardly any hopes raised on cartoons alone have answered expectation; for the practice of the brush is so different from the port crayon, that it may almost be taken as an axiom, that the more attractive the cartoon the less attractive will be the fresco; and I have never found any pupil who made hard over-

[2] Very characteristic of Ardor.

wrought cartoons, ever display with the brush the most distant symptom of nature, truth, or imitation; the most ridiculous expectations have always been excited, the most unbounded anticipations always put forth. Well, the picture was begun, the hand felt awkward, the colour was muddy, the touch feeble, the effect flat, the power of drawing even became poor, till it could scarcely be credited the work was by the same hand, as the promising cartoon. The artist was entirely justified, when looking at a laboured cartoon of Cammucini, the labour of years, when he said, "And after all this trouble comes a bad picture." The cause principally of this incongruity, is the *error* of modern Europe, in making cartoons a *means* and not an *end*, like the ancients. The system of overwrought niggle is German and modern Italian; the cartoons of the school of Athens is the thing—indeed Raphael was but twelve years in the Vatican, if six had been occupied with *one* cartoon, how many frescos would he have done? the native spirit of the British school will prevent this waste of time, and then common sense will also prevent their making cartoons an *end* instead of a *means*, and if they thus consider them under this head, there will be no danger of any injury accruing to their power of pencil.

The landing of Cæsar, No. 61, is a head prize, and in my opinion most unjustly—Cæsar is paltry in character, stature, and expression—certainly not the Cæsar of Cicero, Suetonius, Sallust and Bacon; he looks like a Centurion engaged in a scrabble. It would be impossible to conceive he was meant to be a great general, the "*præsens divus*," watching the landing of an army; there is no army, there are a few boats in the sight, without order or plan, naval or military!—Who is a furious little ancient Briton darting his spear at?—Why is another pulling down in a fury the rocking horse he rides?—Why is one Roman soldier scrambling up and another down?—What is the meaning of all the scramble?—What authority is there that all the Britons had short arms, short bodies, and bandy legs?—Had they not got knee pans? was not the inner ankle higher than the outer in the ancient Britons?—There is no evidence of a clear comprehension of story, no nature in character, no dignity in action, no drawing, no knowledge of structure, no beauty, no grace, great dash of *conté*, great power of effect, great impudence of execution, but no mastery of form; infinitely inferior to 63, close to its side, and altogether an unaccountable specimen of the system of La Roche's school—the costume school of La Roche—for, of the naked, it is evident, neither master or pupil know much. I am quite astonished, and respectfully enter my humble protest against such an honour bestowed, to the injury and insult of the British school. It is perfect infatuation, and is evidence beyond controversy of the absolute necessity of professors being settled at the Universities, to prevent men of fashion making such decisions. If the general proportions of the human form had been explained at college, it would have been impossible for any men of station to have made such a mistake.

First Trial by Jury (105)—A fine cartoon, composed with ability, but not drawn equal to Alfred and the Danes. Alfred and the Danes, as a work of composition, power, and expression, is admirable, and was fully entitled to one of the highest prizes. No. 125, the Fight for the Beacon, is an admirable, a daring, masterly, powerful, ill-drawn, vigorous group, the student will do greater things—but this stamps him as a man of genius. St. Augustine (100) is a beautiful cartoon, adapted for fresco. Una and Satyrs (10) is as fine a specimen of correct drawing as any school could produce in the world; Una wants beauty of feature and swelling of lip, to touch our hearts. 78, Boadicea haranguing the Iceni, is a beautiful evidence of extraordinary power of handling. 104, Alfred submitting his Code of Laws, is weak in power of drawing, but an excellent cartoon. Caractacus (84) is a very fine work, largely drawn, a little approaching to manner how superior in dignity to Cæsar! how poetically treated is Caractacus! there are symptoms of a feeling for colour in the head and sky; but I do not anticipate much power of painting; there is no look of touch in the chalk, and occasional feebleness in the drawing—still it is a grand work. 82, A Skirmish between the Picts and Romans, is a magnificent work of art—full of vigour without exaggeration, and power without violence. Think of what cartoons have carried off prizes from this! It is painful. 135, is a fine specimen of pictorial management in a cartoon. 138 is by a boy of 16, and a fine instance of expression, though the convulsive man is overdone. The Death of Lear (26), is a noble work, finely composed, and not overdone in breadth and style.

How easy it is to see the cartoons of painters. I would divide such works into the cartoons of those who know how to paint—cartoons of those who give promise of painting, and cartoons of those who will never paint at all; I fear there are a great many here of the latter character. These are, I think, all the principal cartoons. Yet there is one of Constance on the ground (27), a very fine work, though a little hard—still it is finely correct in drawing and costume—everything is distant, yet in keeping, nothing slurred yet nothing obtrusive; it announces a correct eye, nature, composition, and drawing; it has no prize: how could they prefer Eleanor to this, or Lear, or Alfred in the camp of the Danes, or a skirmish with the Picts, or half-a-dozen others. Really the judges had no difficult task, the gradation of merit is palpable, and surely if the artists had made a respectful stand, many things might have been prevented, which must give the judges pain now. The great error was, coming to any decision before the public had been admitted; this was the practice of Greeks and Romans, viz., always to admit the people before deciding on works of art; had this been done, the pupil of La Roche, amiable as he is, would never have had a first prize, so strongly would the public feeling have been expressed:—in future, it is the safest plan, unless any portion of the judges have a predilection for a particular cartoon, and fear the public, then, it had always better be done with closed doors. Though the country is convinced the names of the judges were a guarantee for honor and integrity, yet they have all the habits of society, so much is done in a pleasant party, so beautiful is the influence of women, such are the concessions due to breeding, that there is no hope of absolute justice unless you admit the people—their voice is the voice within, and after their decision from impulse, politeness is of no avail. I would therefore earnestly recommend in future this to be done, to silence all cant.

The object of the wealthy is amusement; nothing contributes so much to relieve ennui as novelty; and nothing can be newer than a young man they never heard of, producing a work they never saw, or a subject they never thought of before. This is the bane of English society, no youth is ever suffered to mature the talent he displays, by continued kindness; but, the wonder of one season, he becomes the bore of the next, and his mind is tortured and his heart lacerated, at the successive discovery that all the praise bestowed on his works had been for years bestowed upon others who had disappeared, and would be bestowed on those with equal sincerity who had not yet made their appearance: artist or poet, admiral or general, beauty or deformity, all contribute their share in the wonders of the season, which lasts about three months. Whilst this pernicious system is confined to the patronage of *private circles*, it is well enough, for all share the evil and the good; but carried into a *great system of public patronage*, its effect will be deadly in the extreme: if we are to have a succession of wonders, first in cartoons then in carving—one year in glass and the next in fresco, how far shall we be fit to decorate when the houses are ready?—we shall not have advanced one jot, and be as much at a loss five years hence, as we should be now, if Barry was to announce the walls are fit for decoration. When Cornelius was here, he said, "Now is not too early to begin the cartoons!" Two years are past, and no plan is defined; we are trying for genius, as we were then, and as we shall be to the last hour, six years hence. With these tendencies, the following hints may not be useless. Take care you do not waste yourself with experiments, and be glad to get a cheap decorator after all. Take care you do not pursue the discovery of new genius with such keenness, as to fix on a new boy of 16, the last year. Take care, from a desire to give every body a chance, the decoration be not a series of thoughts without basis or connexion. Try no more experiments to prove the incapacity of the British, for every trial will prove they have greater claims to employment than you wish to see. Fix on a plan for decoration as early as possible, and let each individual work, fresco or oil, be but a part of the general development. That the upper classes are sincere there can be no doubt, only the government must not let their delightful and volatile habits intrude on the solemnity and dignity of a plan, which is meant to honour the legislature, the people and the sovereign, and develop to its full extent the hidden and bursting genius of the country.

With respect to the selection of fresco or oil, fresco beyond all question is to be selected for architectural decoration, *provided* the continental principle of superior and subordinates be adopted; but not else, if the Commission wish the country to be saved from disgrace. The same system which

ensured the victory of Waterloo, the successful termination of St. Paul's, and will ensure the successful completion of the Houses, viz. a general and officers, an architect and pupils, must be adopted if fresco be chosen; the absurdity of gratifying the democratic independence of British artists, where every one thinks himself able to guide, is ridiculous; all will be confusion—lime, mortar, splash, cut, scramble and failure. I will venture to say the young men do not desire it, and no young men can be more easily led, if their affections are touched, than the British. They have now been fairly brought out, and I hope they will not be deserted; but I advise them, if they have any sub-employment which gives them bread, not to neglect it if they have mothers to maintain, sisters to protect, or relations to help; let them paint quietly what they are wanted to do, so as not to depend on the caprices of governments, keep their independence by honest means, and to remember they have shown more talent than was expected, though *not by me*, and more than was desired by many who longed for their failure.

Now as to the style of design for the walls; must it be in the perfection of art and reality, or must it be the art which was extant when Gothic architecture began? After the Fall, shelter was early as much a necessity as food, hence arose huts and columns, roofs and houses; then leisure and peace generated ornament, and thence arose perfect architecture and its orders. Architecture therefore preceded art, and must have been in a high state, when art was in infancy; but it does not follow that art in infancy is more in character with architecture in perfection, because from causes over which it had no controul, it was in infancy when architecture was perfect! The association may be powerful, but at this time of day, when art in perfect state has been discovered, the association may be rendered as infallible, by uniting perfect art and perfect architecture, as it is now strong in its imperfection. No man will assert the British people were not as handsome when Westminster Hall was built as now,—no one will assert they walked on tip toes, as they were painted, or stared as they were painted, or looked as flat as they were painted at the time,—no man will assert that light and shadow were not as powerful *then* as *now*—that colour was not as brilliant, and forms not as well knit, and if these things are represented on Gothic buildings the reverse, it was not on principle, but ignorance; what absurdity then to go back to the ignorance as if it were principle, instead of boldly breaking the association by making common sense the guide, and giving us Britons as we know Britons were, because if Britons were such poor creatures as they were painted, neither Westminster Hall or Westminster Abbey would ever have been built, conceived or finished.

It may be said there is a limit—*there is*; the florid vulgarity of Rubens would be as unfit as the starved impotence of Cimabue. The cartoons of Raphael appear to me to be the medium, not inconsistent with colour, or light and shadow, form or expression, nature or idea; and to *this* style I earnestly hope the artist will look, independent as it is of the whiskered ferocity of the German, the theatrical pedantry of the French, or the careless neglects of the portrait English.

With the power of drawing, visible in this exhibition of cartoons, nothing need be feared; and the great superiority of the British school in construction and form, to the French school, as exhibited in the pupil of La Roche, is a singular feature. La Roche's pupil was brought over by a noble lord to floor the school, and the school has floored him; the reason is, the British begin by the skeleton and construction, all over the country, and *if they continue*, no school on earth will surpass them; and there is no knowing to what extent they will go, whilst the French, (Ingres and La Roche,) do not investigate construction till boys have got a relish for the brush, and then, anatomy and construction are tedious things! Great honour is due to the academy school, for all I praise are students, and if the present keeper does not permit himself to be *Germanized*, every excellence may be expected still. There is one affectation, which must not be mistaken for a beauty—the competitors, who have been abroad, make a black line round their figures; before tracing for the wall this may be well, but the absurdity of doing such a horror, to show you know it is to be done, is contemptible and pedantic. God keep the British students till the eleventh hour from such a detestable obstruction to rotundity. The desire people of fashion have for what is new, is a danger to be guarded against by the Commission; the chances are, if the plan of design be not soon settled, and the artists set properly to work, when the walls are ready, the whole may fall into the hands of young men, for the sake of giving them a chance, as it is said, and the whole thing become a ridicule from the most generous feelings. It cannot be too often repeated, that the caprices of the cliques of fashion, who have regularly, with the kindest intentions, flattered and entrapped, deserted and ruined, a succession of generous youths, who believed all they were told, till poverty undeceived them, should not be permitted to gain ground, in the dignity of public patronage, for nothing will be the result, but crude experiments without hope, and futile consequences without genius; the government finding the public money wasted in vain, will become hopeless of raising art, or improving the people, and that honourable members may be no longer annoyed, will hurry the affair into the hands of some hasty decorator, who glad of a job will do it cheap, and render Briton again the bye word of some future Winkleman, or some future Du Bos, and ages will again pass without such another moment.

HENRY ARDOR.

Here my dear friend left off, and I must add, what I am sure every reader will agree to.—God keep us from such a misery. If I find any more papers of my late dear friend, Mr. Editor, I will regularly forward them, and beg to say I am.

ARDOR'S EXECUTOR.

P.S. I am quite sure if anything goes wrong in the commission, I shall be honoured by a visit from Ardor's ghost, from which Heaven defend me.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

March 21.—The PRESIDENT in the Chair.

"*Description of the Blast Furnaces and of the Barrow used for filling the Charges of Mine and Coke into them, at the Butterley Iron-Works, Derbyshire.*" By S. C. Kreeft, Grad. Inst. C. E.

The three smelting furnaces described in this communication are situated at Butterley, in Derbyshire; and three others, belonging to the same proprietors, exist at Codnor Park Forge, about 2½ miles distant, where their produce is converted into malleable iron.

In the internal form or dimensions of these furnaces there is not any peculiarity; the diameter over the hearth is 4 feet, over the boshes 15 feet, and at the charging-plate 8 feet—the total height being 45 feet.

The stacks, however, differ from the ordinary form in their external construction. The base of each is 40 feet square, battering inwards at an angle of 71 (3 inches to 1 foot); the quoin-stones and course work being laid at right-angles to the battering line, or at angle of 16 with the horizon. Instead of the usual semicircular arches over the tuyeres, pointed Egyptian arches are substituted, and an open vertical joint or separation in the masonry is left from the apex of the arch up to the top of the stack on all the four sides. This is done for the purpose of obviating the evils generally arising from the expansion and contraction of the stack in heating and cooling, from which the keystone of the semicircular arch usually falls, and the work cracks all around. With the pointed arch, the vertical joint in the masonry merely opens from the heat, and in contracting resumes its former position, without any injury to the other joints of the masonry or deranging any of the archstones. The stacks are confined in the usual manner by wrought-iron braces, 2 inches diameter, built into the walls, with washer-plates and cotters at the extremities.

The mode of filling or supplying the materials into the furnace is particularly described. It is by means of a circular barrow of wrought iron, running on four wheels, the shafts by which it is guided, being so arranged as to form a steel-yard balance for weighing the contents of the barrow; the bottom is conical, and is capable of being raised or lowered by a rack and pinion, which is worked by a rod placed between the shafts, so that when the workman has pushed the barrow over the furnace-mouth, he can, by turning a handle, lower the conical bottom and distribute the materials equally around the interior periphery of the furnace. This regularity in depositing the materials is of importance to the good working of a furnace, and would alone render the barrow an improvement on the ordinary mode of filling, but it is also found to be more economical in every respect.

The charge for good forge pig-iron is—

Coal	.. ..	9 cwt.
Argillaceous iron ore from the coal measures	..	10½ „
Calcareous ore from the Peak of Derbyshire	..	2 „
Limestone	.. ..	3 „

Four and a quarter charges produce 1 ton of iron, or 38 cwt. of coal to 1 ton of iron.

The average produce of each furnace is from 90 tons to 120 tons per week.

The average results of yield of the furnaces may be taken thus:—

For the Years	1839.			1840.		
	Tons.	cwt.	qr.	Tons.	cwt.	qr.
Calcined mine used	18,481	7	3	19,521	19	2
Peak ore used	..	..		676	16	0
Average mine used per ton of iron	2·76	0	0	2·66	0	0
Limestone used	6·794	15		6·694		
Average limestone per ton of iron	·99	0	0	·88		
	Tons.	Tons.	cwt.	Tons.	cwt.	
Average quantity of coals per ton of iron, No. of charges 5·26, or	2·37 =	2	7	2	1	
Coal to blast engine ..	·15 =	0	9	0	7½	
„ to heating blast ..	·25 =	0	5	0	5½	
„ to calcine mine ..	·10 =	0	8	0	9	
Tons ..	3·47 or	3	9	3	6	
Quantity of metal made	6,822			7,630		

Three of the furnaces are blown with air, heated to about 680 Fahrenheit.

The engine has a blowing cylinder of 80 inches diameter, with 8-feet stroke, discharging 558 cubic feet of atmospheric air at each stroke, under a pressure of 3 lb. per square inch, or about 7800 cubic feet per minute; the diameters of the nozzles of the blast-pipes vary from 2½ to 3 inches, according to circumstances.

The principal dimensions of the furnaces are given, and the communication is illustrated by two drawings of the furnace and the barrow, in plan and elevation, with details of construction.

Automaton Balance for Weighing Coin.

"*Description of the Automaton Balance for weighing Coins, invented by William Cotton, Esq., Governor of the Bank of England.*" By Thomas Oldham, Assoc. Inst. C. E.

The paper first gives a brief notice of a portion of the bullion transactions of the Bank of England, in order to explain the difficulties which led to the invention of the machine. The new coinage first arrives at the Bank from the Mint in what are called "journies," a single journey weighing 15 lb., and containing 701 sovereigns. The officers of the Mint are allowed 12 grains plus in every pound-weight of metal, for the irregularities incidental to working it into coin, but they usually work to within half that allowance, which is technically called "the remedy."

There have been coined for the Bank lately 8,000,000 of sovereigns, and the greatest variation from the weight allowed was only 60 grains, or one-third of the remedy: each sovereign should contain a portion of this remedy, to allow for wear in public use, and this extraordinary subdivision of the metal is invariably obtained. The usual delivery of new coinage at the Bank contains 100 journies, which is counted by weight only—that is, 200 sovereigns are counted into one scale, and the rest of the delivery is weighed in parcels which balance these 200, and this is all the counting the new coinage receives. The regularity and precision of the manipulations at the Mint obviate the necessity of any further examination, either as regards the gross amount or the weight of an individual piece.

When the currency returns to the Bank from the public it becomes necessary to ascertain if it has been reduced below the standard weight, and this imposes an arduous duty on the officers of the Bank. The amount of gold paid daily over the Bank-counter varies considerably, but 30,000 may be taken as a rough average, and hence arises a tedious, irksome, and expensive process in weighing so large a number of pieces singly and in quick succession, separating, at the same time, the light from the standard coin.

The mode of weighing coins by hand requires much dexterity, practice, and attention; but, in spite of all these, errors were inevitable, and it was to obviate these that the machine was invented by Mr. Cotton, the Governor of the Bank of England: it was constructed from his plans, by Mr. Napier, (of York Road, Lambeth,) and is thus described:—Its exterior presents a plain brass case, with a small hopper tube on the top plate, about 1½ inches from which there is an opening in the top plate. In this opening is seen a platform in the form of a quadrant. This platform is suspended above one end of the beam, and is to receive the coin to be weighed. On one side of the case is a till—to receive the sovereigns as they are weighed—partitioned so that one division is left for standard coin, and the other for such as are light. There is a sliding door to each division, for removing the coins at pleasure. The machine may be worked like a clock, with a weight, or by any simple application of power.

Its visible action is as follows:—The hopper being filled with gold, upon setting the machine in motion, it immediately places a sovereign on the little platform which serves, as already stated, in place of a scale-pan, and if it is of standard weight, a small tongue comes rapidly forward and pushes the sovereign into that side of the till allotted to such coin; if light, another, and similar tongue to the first, pushes the sovereign into the other side of the till. The action of these tongues is at right angles to each other. While a sovereign is being weighed, a succeeding one is on its way from the hopper to the platform, and the moment the preceding sovereign is disposed of, according to its value, another is placed in its stead. To keep the hopper supplied with gold, and remove it from the till as it is filled, is all the attendance necessary.

The more minute parts of the mechanical arrangement of the machine, such as the fulcrum, the forceps, &c., are described in detail, and the following statement by Mr. Miller is given, as a comparison with the old method of weighing:—"With the bullion-scales 4000 may be stated as the number a person can weigh in six hours. As the sovereigns now tendered at the Bank-counter are most of them new, the scale dips quickly in weighing, and one person can weigh 5000 in six hours; but a short time ago, before the issue of the new coinage, the same person could only weigh 3000, as it took a longer time for the scales to indicate. The bullion-scales cannot indicate nearer than $\frac{1}{100}$ths of a grain at the above rate. The machine is perfectly free from the sources of error to which the scales are subject, and weighs as quickly, whether sovereigns are new and of full weight, or old and doubtful; it can weigh 10,000 in six hours, and divide coin varying only $\frac{1}{70}$th of a grain."

The paper is illustrated by two drawings of the internal arrangement of the machine, and a model showing the action of the tongues and platform.

Remarks.—Mr. Oldham exhibited the automaton balance at work weighing coin; and after describing, with the aid of a diagram and model, the action of some of the more delicate parts of the machine, he observed that in seeking to obtain extraordinary performances by machinery, mechanical propriety of construction was too often overlooked, and premature deterioration in the action of many parts was the result. The automaton balance was peculiarly worthy of notice from the judgment exercised in its relative proportions, as was proved by the fact that, after being at work for several months, it had become more delicate in detecting slight variations between standard and light coin than when it was first constructed. Mr. Cotton's object in this invention should be well understood. Public convenience demanded great accuracy in weighing the currency; by the ordinary mode of weighing gold with the bullion scales—although it was due to the bank-tellers to state, that they gave the utmost attention to their monotonous duty—it was nearly impossible to guard against the various difficulties detailed in the paper. The injury sustained by the optic nerve, from constantly watching the indicator of the scales, was a serious inconvenience to the operative, which, coupled with the incidental sources of error referred to, created even greater absence of delicacy than the paper stated. Errors to the amount of one-third or even half a grain were not unfrequent. By the "automaton balance," the number weighed in a given time was increased, and undeviating accuracy obtained. The delicacy of the instrument was such, that from 30 to 35 coins per minute could be passed through the machine, detecting a difference of only $\frac{1}{50}$ of a grain. It should be mentioned that much greater delicacy could be accomplished, that is, to the $\frac{1}{100}$dth of a grain, but not at the same rate; because it would be understood that a slow action of the beam was necessary for very small variations, and that must regulate the speed of working; but such delicacy was beyond all useful purposes in those transactions which it was intended to improve.

Mr. Cotton said that his attention had been attracted to the point by the inconveniences to which the "tellers" were subjected in weighing gold for the public with balances so delicately constructed as the bullion scales, the agitation of the air by the sudden opening of a door, or even by the breathing of those around, sufficed to cause errors. It was possible, also, by pressing the fulcrum against the bridle, to produce such a degree of friction as materially to interfere with accuracy; and the tellers confessed, that after weighing two or three thousand coins the sight was injured, and they no longer observed with the same degree of correctness. He therefore imagined that a machine might be contrived, which being defended from external influence, might weigh coins as fast as by hand, and within one-fourth of a grain; but he certainly did not contemplate attaining such perfection as the machine now possessed. His first idea was, that the light coins should be taken off by a forceps, and that those of average weight should be pushed off by the succeeding ones; but it was found, that the slightest inaccuracy in the milled edges sufficed to give them a wrong direction: therefore, when he made the first rough sketch, and consulted with his friend, the late Mr. Ewart, he recommended that Mr. Napier, of York Road, Lambeth, should be employed to make the machine, and to him was due the suggestion of the two alternately advancing tongues, as well as several other arrangements of the machinery, which he had so successfully constructed. When the first machine was tried, out of 1000 sovereigns, 160 were found to be light. They were given to a teller to be verified, and he returned several of them as being of the proper weight; but upon again weighing them more carefully, the result given by the machine was found to be correct. As an instance of how many circumstances should be taken into consideration in delicate machines, he might mention that, after being used for a time, the machine varied in its results, and on examination it was discovered that the

end of the lever, which traversed the pendant, had become magnetic, and thus affected the balance. An ivory end was substituted, and ever since that period its accuracy had been maintained.

Mr. W. Miller observed, that the efficiency of any scales must be determined, in a great degree, by the fineness of the edge of the fulcrum of the beam; and it would be easily imagined that the friction, to which the edge in a pair of bullion scales was subjected whilst weighing five or six thousand sovereigns per day, must soon impair its delicacy, and consequently the efficiency of the whole apparatus: for, whether the sovereigns were light or heavy, the beam must turn upon its fulcrum. Such was not the case with Mr. Cotton's machine: its beam did not act at all, unless a light sovereign was placed upon the platform; so that among 1000 sovereigns, if only 100 were light, the beam of the machine would only move 100 times, while that of the ordinary scales would oscillate 100 times. An immense advantage was thus given to the machine in point of durability. All weighing was but an approach to correctness, and the nearest point to which the best kind of common scales were sensible, might be stated as $\frac{1}{100}$ of a grain, and one-fourth of a grain would hardly cover their errors; but the machine was sensible to $\frac{3}{1000}$ of a grain, and $\frac{3}{100}$ would fully cover its errors, which were not a twentieth part so numerous as those of the scales.

Woollen Factory for Turkey.

Mr. Fairbairn exhibited a model, showing the plans, sections, and architectural elevation of a Woollen Factory, to be constructed of cast and wrought iron, near the town of Izmet (Turkey), for the Sublime Porte.

Mr. Fairbairn said that, in 1839, he visited Constantinople under the instructions of the late Sultan Mahomed, and reported upon nearly all the government works. Their extension was checked by the death of that prince, but the present Sultan was disposed to carry them into effect, and by his orders Mr. Ohanes Dadian had arrived in England, in furtherance of the plans for ameliorating the state of the Turkish community by introducing useful arts and manufactures, in which he was aided by his Excellency Ali Effendi, the ambassador to the court of England, and the consul-general, Mr. Edward Zohrab. Almost all the houses, and many of the public buildings, in Turkey, being constructed of timber, destructive fires were frequent. In many parts of the country the common building materials were expensive; iron had therefore been resorted to for construction, and Mr. Fairbairn had already sent over an iron house for a corn-mill, 50 feet long, 25 feet wide, of three stories in height, and with an iron roof. It was finished in 1840, and erected at Constantinople in the succeeding year. The success of this attempt induced a second order, which was for an extensive woollen factory, to be composed entirely of cast iron plates, the interior being formed throughout of brick arches, upon cast-iron columns and bearers, with an iron roof. He then described in detail the construction of the different parts of the building, and the machinery, which would be driven by a fall of water of 25 feet in height, of the computed average power of 180 horses. Several ingenious devices were described for preventing any objectionable effects from the high conducting power of the metal. The piers between the windows were hollow, so as to admit a current of air through during the hot season; and the iron roofs were so arranged as to have beneath them a coating of plaster, to serve as a non-conducting substance. The two principal rooms were described to be 272 feet long, 40 feet wide, and 20 feet high; and 280 feet long, 20 feet wide, and 20 feet high: with a great number of other rooms, for the several processes in the manufacture of coarse woollen cloths, for the counting-houses and departments of the directors, and for the reception of the sultan, &c. The area of the inclosed surface, including the court-yard and buildings, was nearly 3 acres, or 110,621 square feet.

The floor surface in the basement rooms = 16,480 square feet. Ditto in the upper rooms = 54,616 square feet.

March 28.—The President in the Chair.

Cast and Malleable Iron.

"*Experiments upon Cast and Malleable Iron, at the Milton Iron Works, Yorkshire, in February*, 1843." By David Mushet, Assoc. Inst. C. E.

The blast furnaces at Milton had been for a long period worked with heated air, generally under a pressure of 3 lb. per square inch, and each with two nozzles on the blast-pipes of $2\frac{1}{4}$ inches and $2\frac{3}{16}$ inches in diameter. The apparatus requiring to be renewed, a quantity of iron was made by cold-blast, which, as the materials or other circumstances of manufacture were not in any way changed, offered an opportunity of testing the relative strength of the two sorts of iron, of which Messrs. Graham and Co., the proprietors, took advantage, and secured the assistance of Mr. Mushet to conduct the experiments. A strong wooden frame was erected, upon which were fixed iron supports at 4 feet 6 inches apart, for sustaining the bars to be proved. A bar of iron planed perfectly true, with a dove-tailed groove and a graduated brass scale in it, was used for ascertaining the deflection. The bars to be experimented upon were all cast alike, 5 feet long and 1 inch square, and cooled with equal precaution. The results are given in a series of tables, of which the following are the average results:—

Table.	No. of Experiments.	Quality of Iron.	Specific Gravity.	Breaking weight in lb.	Deflection in inches.	Impact.
1	12	No. 4. Cold-blast iron re-melted in the cupola, mottled or approaching to white	7·153	442	·9418	427
2	12	Same iron re-melted in the cupola with an increased quantity of coke produced gray iron .	7·054	435	1·1916	519
3	12	No. 3. Hot-blast iron re-melted in the cupola .	7·012	520	1·542	782
4	13	Nos. 3 and 4. Hot-blast iron re-melted in an air-furnace with coal . .	7·107	610¼	1·532	940
5	10	No. 1. Hot-blast iron cast from the blast furnace.	7·012	439	1·56	686
6	12	No. 3. Ditto ditto . .	7·046	439	1·43	630

The result of these tables are examined, and among the deductions drawn from them are—that the Milton cold-blast iron is rather deficient in strength; that the hot-blast iron is stronger than cold-blast, when re-melted in a cupola with coke; that hot-blast iron from the furnace is equal in strength to the average of the two sets of specimens of cold-blast re-melted in the cupola; that the No. 3 iron from the blast furnace is not stronger than No. 1 quality. The general results show, not only the superiority of the Milton hot-blast iron over that made by cold-blast, at the same furnaces, but over that of a very large number of works, as shown by the following comparative table taken from Mr. Fairbairn's report in 1838:—

				lb.
Milton, hot-blast iron,		No. 3	Air furnace	610¼
Ditto, hot-blast		„ 3	Cupola	520
Ponkey,	cold-blast	„ 3		581
Bute,	ditto	„ 1		491
Windmill End,	ditto	„ 2		489
Old Park,	ditto	„ 2		485¾
Lowmoor,	ditto	„ 2		472
Buffery,	ditto	„ 1		463
Brimbo,	ditto	„ 2		459
Oldberry,	ditto	„ 2		455
Adelphi,	ditto	„ 2		449
Blaina,	ditto	„ 3		448
Devon,	ditto	„ 3		448
Frood,	ditto	„ 2		447
Milton,	ditto	„ 4		438½
Elsecar,	ditto	„ 2		427

The waste in re-melting the hot-blast iron was under 2 per cent.

	Cwt.	qrs.	lb.
There was charged in the cupola, No. 3, pig-iron . . .	20	1	0
Pigs and scraps obtained	19	3	14
		1	14

The results of the experiments upon malleable iron made from hot-blast pig, and plate, show extreme ductility, when subjected to blows of a hammer 24 lbs. weight, of which one example will suffice. A bolt 2¼ inches diameter, puddled from refined metal, notched half round to the depth of one-eighth of an inch, required 120 blows to break it.

Remarks.—Mr. Cottam remarked, that the paper would have been more satisfactory, if it had stated more particularly the progressive additions of the weights, the intervals of loading, and the length of the periods during which the bars remained loaded. He had found that when a beam was near the point of fracture, if the weights were added quickly, it would apparently bear more, than if a certain time was suffered to elapse between their application. His practice in experimenting was to make small additions of weight, at given intervals, which might be increased in length toward the point of fracture; more correct results were thus obtained.

Mr. Lowe believed, that in making iron, the main consideration after selecting good materials, was to proportion them according to the hygrometric state of the atmosphere. It was well known that better iron was made in frosty weather than in damp warm weather; and he was convinced that the more air was deprived of its moisture, the better would be the effect.

Mr. Parkes observed, that the experiments on the strength of the wrought-iron bars could scarcely be received as conclusive, as the power employed had been variable and ill-defined. If a given weight had been allowed to drop from a certain height, and the incisions in the bars had been made with

precision by a machine, the power required to produce fracture could have been easily calculated, as regarded the impact.

Mr. Farey observed, that notwithstanding the difference between the results recorded in the paper, and those arrived at by Messrs. Fairbarin and Hodgkinson, he was inclined to place confidence in them on account of Mr. Mushet's known accuracy as an observer. He thought that the disrepute into which hot-blast iron had fallen was unmerited, that it was occasioned by want of care, and the use of inferior materials in the manufacture. He considered Mr. Neilson's invention a most important improvement in metallurgic operations, but it had been abused because, by its means, ores which were formerly difficult of reduction, and therefore thrown aside, had since been economically fused, without due regard to their chemical constitution, and the metal produced was variable in quality and sometimes deficient in strength. Nevertheless, Mr. Mushet's experiments showed that when proper care was exercised in the selection of the materials, and in the working of the furnace, the Milton hot-blast iron, when re-melted in the air-furnace, attained the high breaking weight of 610¼ lbs., which was greater than that of the best specimens of cold blast iron. Mr. Farey then described at length the chemical combinations which occurred in the blast furnace. The general result was, that the use of hot-blast accelerated the process of separating the oxygen from the ore, and of replacing it by carbon, rendering also the subsequent fusion more rapid and complete. A great advantage was obtained by avoiding the cooling effect, which was formerly produced by the introduction of a quantity of cold air under pressure . the point of fusion was higher up in the furnace, and the quality of the metal, when it fell into the hearth, was not injured by being blown upon, as it was protected by the covering of liquid slag at a high temperature which descended upon it. The deoxydation and absorption of carbon being facilitated, the metal contained a redundancy of carbon, notwithstanding a less quantity of fuel was consumed. It was probable that the want of strength sometimes observed might arise from the imperfect amalgamation of the carbon with the metal, and this would account for the strength being increased by re-melting, particularly in the air furnace, wherein the process was more gradual than in the cupola. This gradual process was not desirable for cold-blast iron, in which the carbon was already well distributed; therefore in almost all foundries, the air furnaces had been replaced by cupolas, as in the latter the iron was melted much more rapidly. When the use of hot-blast was first proposed, it was supposed that it could not answer, because in all furnaces, better iron was generally made in the winter than in the summer. This was a fallacy which ought not to have been entertained, as it was well known that the good working arose from the dryness of the air in the winter, on which account the water-regulators for the cold-blast were generally abandoned, and large dry reservoirs, with or without floating piston regulators, were erected in their stead.

Mr. Field corroborated Mr. Farey's statement of the iron, when re-melted in an air furnace, becoming hard and brittle. He had in consequence abandoned their use, and made even the heaviest castings from cupolas. He attributed the deterioration of the iron to the slowness of the process of melting in the air furnace. He had found the No. 1 hot-blast pig-iron too rich and weak for general purposes; the No. 3 generally possessed the greatest strength.

Mr. Rennie, in answer to a question put by Mr. Farey, said, that in his experiments, the transverse strength was 750 lbs.; and when the bearings were 3 feet apart, the strength was 897 lbs., with specimens of good quality.[a] He believed that in some experiments on iron made with anthracite, published by Mr. Mushet in 1836, the cold-blast iron was shown to be from 16 to 27 per cent. stronger than that made by the hot-blast process. This might have arisen from peculiar circumstances, as Mr. Crane, of Ynischedwyn, had shown him a pig of hot-blast iron, which had resisted upwards of a hundred blows of a sledge-hammer, while the ordinary cold-blast pigs were generally broken by about a dozen blows. From the discrepancy shown by the various experiments, he was inclined to think that the knowledge of the real effects of heated air, in reducing metallic ores, was at present very limited.

Mr. W. Brunton said that the only place where iron had been made with anthracite and cold-blast was at the Ystalyfera works, South Wales; and the report by Mr. Mushet, which had been alluded to, was upon the iron made there. The black band iron-stone had recently been found at the Beaufort iron-works, South Wales; and as the furnaces were now blown with heated air, a large quantity of good soft iron was produced. That mine had been tried in the raw state, but the result had, he believed, been doubtful.

Mr. Davison submitted that the want of strength, which was complained of in the hot-blast iron, might in some degree arise from the use of raw coal instead of coke in the blast furnace, as the sulphur and other deleterious matters, which were formerly got rid of in the process of coking, were now introduced to the furnace, and probably combined with the iron.

Mr. Vignoles agreed with Mr. Lowe, that the hygrometric state of the atmosphere had much influence on the quality of the iron produced. It was found in India that even with the rich hæmatite ores and charcoal, which were solely used by the native workers of metal, good iron could not be made when the air was charged with moisture: but that during the hot dry winds the best metal was produced.

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any simple ap,

[a] Phil. Trans. 1818, p. 133.

Mr. Carpmael said, that during a recent visit to the Ystalyfera iron-works, he had tried some experiments on the strength of the iron then being made. The bars were 1 inch square, placed upon bearings 4 feet 6 inches apart, and were carefully and gradually weighted, the deflection being ascertained by an apparatus for the purpose.

No. 1 specimen, loaded with 588 lbs., deflected 1¼ inch, and sprung back when unloaded without any permanent set. The weights were replaced, and additions made up to 690 lbs., at which point it broke.

No. 2 specimon, with 660 lbs., deflected 1½ inch; with 718 lbs. it deflected 1⅜ inch, and broke with 742 lbs.

No. 3 specimen, with 578 lbs. deflected $1\frac{1}{16}$ inch; with 634 lbs. it deflected $1\frac{5}{16}$ inch, and broke with 774 lbs.

At the Ynischedwyn works, where hot-blast and anthracite were used for smelting the ore, the pig iron exhibited greater strength than any Scotch iron that he had ever seen. It appeared to him that, in the Scotch iron-works, the object was to produce a large quantity of metal without due regard to its quality.

Mr. Parkes remarked, with reference to the experiments upon wrought iron, that the test by blows of a hammer was not sufficiently substantive to be received as authority for the actual strength of iron: it frequently occurred in practice that bar iron, which, when tried by breaking on an anvil, exhibited brittleness after being forged by a smith, had proved tough and good. Neither did he conceive that the capability of a beam to sustain a given weight suspended from its centre was a proof of its fitness for resisting impact, torsion, and other strains to which machinery was subjected. On these grounds he did not receive the experiments either of Mr. Fairbarn or Mr. Mushet as satisfactory, or as true indications of the absolute strength of the iron. A mode of testing should be introduced, which would show whether the improvements in making iron affected the quality of the metal produced, or whether they were restricted to charges in the method of manufacturing.

Mr. Farey remarked that, in Mr. Fairbairn's experiments, the deflection had been carefully noted, and the power of resisting impact had been calculated by multiplying the breaking weight in pounds into the ultimate deflection in inches.

Mr. May regretted that, upon the subject of such importance as the manufacture of cast iron and its capabilities, so little positive information was recorded. The field for scientific inquiry was very extensive, and although many men of high attainments had entered upon it, at present the results were not satisfactory: this, he believed was only to be accounted for by the fact, that the habits of mathematical investigation of the experimenters, had led them to examine the theoretical rather than the practical part of the subject. His experience of Scotch hot-blast iron, induced him to declare it deficient in strength and tenacity, but it did not follow that all hot-blast iron should be bad; on the contrary, he believed the process to be a great step in metallurgical science, from which important results would be obtained; but it had unfortunately afforded an opportunity for working up inferior materials, to the manifest detriment of the founder and the engineer. If, however, at present such was the result, it was to be hoped that the attention of manufacturers being directed to the point, an amelioration, would be speedily introduced, and to this the discussion by the members of the institution might materially contribute, and thus a great benefit would be conferred on the mechanical world.

Mr. Mackain objected to the condemnation of Scotch hot-blast iron, as he had found much of it fit for general purposes, although it was not so strong as that made with cold-blast.

Mr. Ransome corroborated Mr. May's opinion of Scotch iron. It was so weak that the pigs frequently broke in unloading; it was necessary to mix a large quantity of old iron with it, in order to give the castings for machinery the requisite amount of strength.

Mr. Nasmyth had used great quantities of Scotch iron, both for large and small castings, and could not rely upon it for machinery: it was deficient in strength, and the contraction of the metal in cooling was so great as to cause frequent losses to the founders who employed it. Indeed he conceived that nothing but the lowness of its price had caused it to be so extensively used; yet, in his opinion, this, reduced commercial value marked its inferiority for there must exist some good reason why hot-blast iron should only sell for 45s. to 50s. per ton, when cold-blast iron cost 80s. or 90s. He had for a long time used but little of it, and that only to mix with the harder qualities of iron. He did not attach much faith to experiments tried upon bars of such small dimensions, and merely by suspending weights to them. He was of opinion that the masses of iron should be of larger dimensions, and that they should be tried under similar circumstances to those under which they were intended to be used.

Mr. Davison said, that some years since, the framing for supporting one of the large vats at Messrs. Truman and Co.'s brewery, weighing 100 tons when full, had been cast of cold-blast Welsh iron, and had stood well to the present time; but that of a precisely similar set of castings made from Scotch iron, two girders had broken the first time the vat was filled.

Mr. Field stated that the high character which had been obtained by the guns from the Carron Foundry was to be, in a great measure, attributed to the care with which the iron employed was selected and mixed. A simple method was in use there for ascertaining the comparative strength of dif-

ferent qualities of iron, and had been found perfectly satisfactory for practical purposes. A wrought iron bar, 1 inch square, was bent into a deeply indented serpentine or zig-zag figure, having three or four bends, each end of the bar terminating in an eye. This was used as a pattern, from which several serpentines were cast at each running of the blast furnace; they were suspended by the upper eye, and a scale being attached to the lower one, weights were gradually added until the castings broke. Such a figure was fractured with very little weight, and the method did not afford any test of the actual strength of the metal; but it was simple, and as the foundrymen could conduct the experiment, it enabled a correct opinion to be formed of the comparative strength of the different kinds of iron under trial, and to make the necessary mixture. The system was used in his foundry whenever new kinds of iron were purchased, and he obtained good results from it.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

June 26, 1843.—Mr. Britton gave an essay on the fine Anglo-Norman Porch to *Malmsbury Abbey Church*, which was illustrated by several drawings. He also referred to, and made incidental remarks on several other Christian porches, comparing and contrasting them with the famed Grecian and Roman Porticos of Pagan architecture. The subject afforded scope for interesting criticism, and was well calculated for a large auditory of young architects. We fully agree with our veteran antiquary in reprobating the absurd and tasteless practice of copying and applying, or rather misapplying, the portico of a Greek or Roman temple to a modern chapel, church, theatre, and common street house, when perhaps no other part of the building has a classical feature; and certainly the whole has no analogy, either in purpose, scenery, or association to ancient eastern edifices. It would be as congruous and correct to place the counsel's, or bishop's, wig on the sconce of the chimney-sweep or dustman; on the contrary, the porch can be applied with harmony and propriety to almost every variety of building—from the church to the workhouse, from the palace to the cottage. Mr. Britton exemplified this very forcibly, and justly, by referring to many diversified examples in England, and also commented on the great varieties of edifice which the monastic architects of the middle ages designed and erected for the use of their contemporaries, and for the admiration of their descendants. The following were particularly noticed:—those attached to the cathedrals of Salisbury, Wells, Ely, Peterborough, Lincoln, Gloucester, Hereford, &c.; also to many in parish churches and chapels, particularly to the unique and extraordinary double porch on the north side of Redcliffe church, and to those of Taunton, Grantham, St. Mary's at Bury, Bishop's Cleve, King's College chapel, &c. His illustrations and comments were, however, more immediately directed to the north Porch of Malmsbury Abbey church in Wiltshire, which he has partly illustrated and described in his "Architectural Antiquities, vols. I. and V., and also in his "Dictionary of the Architecture of the Middle Ages." We quote part of the description of this bold and highly adorned architectural appendage to a church, which must have been originally, when in a perfect state, one of the finest and most impressive Anglo-Norman edifices in the country.

"The door-way, with the whole of the porch, may be referred to and considered as constituting the finest specimen of Anglo-Norman architecture in England. I believe it is unparalleled in arrangement, in elaborate sculptured details, and in its whole design. A large receding archway, with a series of eight mouldings, which extend from the base on one side to the base on the opposite side, are all covered with sculptured enrichments of varied design. Some of the patterns resemble those in Greek architecture and on vases. They are scroll, diamond, and oval-shaped frames, inclosing groups of human figures, animals, &c., intended to delineate passages from the bible and the testament. A label, or hood moulding, with serpent's heads at each extremity, encircle the arch. Within this archway is a large square room, or vestibule, having a stone seat at each side, with columns attached to the walls; a series of arcades, two compartments of bold alto-relievi, representing the twelve apostles, seated on two benches, and two figures apparently flying over their heads. The ceiling was vaulted and ribbed; and, opening to the church there was a smaller doorway, with a profusion of sculptured ornaments, and a basso-relievo of the Deity, or the Saviour, with incensing angels on the lintel. On the right, or eastern side, of this doorway was a piscina, and above the ceiling was a room, with a fire-place, for a monk or porter, who had charge of the church."

July 10.—This evening was occupied by reading the Prize Essay, "Are Synchronism and Uniformity of Style essential to Beauty and Propriety in Architecture," by Mr. Chamberlain, for which the medal of the Institute was awarded.

On Monday evening, the 24th July, the session closed, with a full attendance of members and visitors. Mr. Donaldson read a paper on the domestic architecture of the Belgian cities, illustrated by numerous drawings, displaying the peculiarities of the street buildings of Flanders during the middle ages, as compared with our own. The more general use of stone and brick in the Belgian houses of this class forms one striking contrast with those of England in which timber was, with few exceptions, the principal material.

Mr. Maugham explained Mr. Payne's patent process of saturating timber with sulphate of lime for preserving it from dry rot.

Mr. Tite, V. P., who occupied the chair, closed the session with some observations on the progress and prospects of the Institute, and on the state of architecture as an art, on which he took occasion to make some remarks on the present tendency to an abuse of the Gothic style.

ORNAMENTAL GLASS.

Charles Robert Ayers, of John Street, Berkeley Square, architect, has obtained a patent for improvements in ornamenting and colouring glass, earthenware, porcelain, and metals.—Patent dated July 23, 1842. Specification enrolled January 23, 1843.—If the surface of the glass, earthenware, &c., is to be covered with a plain ground, it is first to be coated with some adhesive substance, such as essence of lavender. A piece of net, or other thin tissue, is then laid over the article, which is to be dusted over with the colouring matter in the state of fine powder. The colouring matter, passing through the holes of the tissue, attaches itself to the adhesive coating. The tissue is then to be removed, and the article submitted to the action of the fire, taking care, in the case of metals, not to bring them to a red heat, as the colour is more easily fixed thereon than on earthenware, porcelain, &c. When the articles are to be ornamented with figures, &c., they are first coated with the adhesive substance, and covered with net, or other tissue, as before. Stencil plates, made of paper or any other convenient substance, in which the figures have been cut out, are then laid above the tissue, and the colours dusted on; after which, *without taking off the net, paper, &c.*, the goods are subjected to the firing process. Another method of ornamenting such goods, described by the patentee, consists in having the figures cut in blocks similar to woodcuts, which are covered with turpentine varnish, and impressed on the article to be ornamented, which is then dusted with the colour or colours, and fixed as in ordinary cases. Claims—1. The patentee does not claim the application of colour to earthenware, &c., in a state of powder, but its application in a state of powder with net or other tissue intervening. 2. The application of stencil plates, of various figures, as above described. 3. The impressing the figures or ornaments by means of blocks, and then dusting on the colour.

WESTMINSTER BRIDGE.

Letter from Mr. Barry *to the* Speaker, *in answer to a Report of* Messrs Walker and Burges, *upon the proposed alterations.*

Sir,—As Messrs. Walker and Burges have thought proper to print and publish a Letter, addressed to you as Chairman of the Commissioners of Westminster Bridge, relative to the suggestions I ventured to offer for the improvement of that bridge, in a Report which I made to the Fine Arts Commissioners, of the 22nd February last, I feel called upon to address to you a few observations, for the information of the Board over which you preside, chiefly with the view of removing several misconstructions which that letter is calculated to occasion.

Westminster Bridge has long been considered extremely inconvenient, as well as unsightly, and, from its proximity to the new Houses of Parliament, is generally felt to have a most injurious effect upon the appearance of that building. As a remedy for these defects, the main objects to be attained are obviously to lower the road-way, to increase the water-way and head-room under the arches, and to reduce the mass of the bridge to the greatest practicable extent. In order to accomplish these objects in the most effectual manner, it appears to me to be necessary to rebuild the bridge; but as the Commissioners were incurring a large outlay in securing and extending the foundations, I recommended in my report above alluded to, that the rebuilding should be confined to the superstructure.

Previously to noticing the several points of Messrs. Walker and Burges' Letter, I would beg to observe, that the suggestions contained in my report were offered merely as hints for the consideration of the Fine Arts Commissioners, and not as mature opinions founded upon a careful practical investigation with reference to execution, in which I stated most distinctly I did not wish to be engaged. I presumed that if the Fine Arts Commissioners deemed those suggestions worthy of attention, they would refer them to the Commissioners of the bridge, by whom they would be duly considered, and, if approved, carried into effect by their own officers.

I now proceed to notice the several observations of Messrs. Walker and Burges upon the suggestions contained in my report. With reference to those upon the relative properties of circular and pointed arches, and to the authorities which they quote in depreciation of the pointed arch as applied to bridge-building, I beg to state, that the hypothesis in which those authorities are said to concur, namely, that a pointed arch requires a greater pressure than a circular arch at the crown, is at direct variance with the opinion of Professor Moseley, of King's College, one of the highest authorities in such matters, who in a letter to me upon the subject states, "that a pointed arch does not necessarily require a great pressure, or indeed any pressure, upon its crown, to prevent it from falling, and that the reasoning

upon which an opposite conclusion is founded in Messrs. Walker and Burges' report is erroneous." Both theory and practice confirm me in the opinion which I have advanced in my report, that a pointed arch requires less thickness at the crown than is usually considered necessary for a circular arch. As, however, it might possibly be inferred from the observations of Messrs. Walker and Burges that the arch which I have proposed is not strong enough for its purpose, although they do not attempt to prove that such is the case, I have thought it right to enter into a careful investigation of its properties; from which I am fully convinced, that I have not carried the principle which I have advocated far enough; and that, considering the insignificant span of even the largest of the proposed arches, it would be no great effort of engineering science to reduce the thickness of its crown to nearly one-half of what is proposed by Messrs. Walker and Burges; by which means the lowering of the road-way over the centre arch might be carried to the extent of 6 feet 6 inches, instead of 3 feet 6 inches, even without reducing the clear height of the centre arch as I have proposed; if such reduction were deemed to be an objection of any importance. In this opinion I am confirmed by the examples of numerous stone bridges both in this and other countries, and also by the judgment of several eminent engineers and mathematicians of the present day.

With reference to the loss of water-way, which I stated was occasioned by the haunches or spandrils of the present arches at high water, I ought perhaps to have explained that I referred to such portion only of the water-way as is affected by those obstructions, which might, however, I think, have been inferred. With regard to the removal of these obstructions, I do not agree with Messrs. Walker and Burges in thinking that it would be unproductive of any useful effect upon the "currents and falls," and I consider the arguments in support of their opinion to be fallacious, inasmuch as they are founded upon the assumed level of high water according to Trinity standard, whereas the present ordinary spring tides, as they must be well aware, rise considerably above that level; on one extraordinary occasion recently as much as 3 feet 6 inches. That some practical good would be effected in giving more head room for craft near to the piers, by raising the springings of the arches according to my suggestion, Messrs. Walker and Burges admit, and I conceive that this advantage alone ought to be a sufficient inducement to remove the present arches and to substitute others of more convenient form; but when it is considered that the opportunity would be thereby afforded of lowering the road-way to nearly double the extent proposed by Messrs. Walker and Burges, without producing the slightest injury to the navigation of the river, the advantage as regards the convenience of the public is so much enhanced, that the propriety of rebuilding the superstructure cannot, I think, be doubted. With respect to my proposition of lowering the centre arch 18 inches, which it appears Messrs. Walker and Burges consider will be "rather a practical evil," as affecting the navigation of the river, it is necessary that I should call your attention to the clear height of the middle openings of some of the bridges above Westminster Bridge, as they have done to those only which are below the bridge. While the clear height of the centre arch of Westminster Bridge is 26 feet above Trinity standard of high water, the centre openings of the modern bridges at Vauxhall and Hammersmith are of the respective heights of 25 feet 4 inches, and 16 feet 1 inch, to say nothing of those of Battersea and Putney Bridges, which are much less, but which I admit are extremely inconvenient. As the largest steamers which pass up the river are those which ply between London Bridge and Richmond, and as their funnels are jointed so as to allow of their passing even under Putney Bridge, the height of the centre opening of which is only 11 feet 2 inches above high water, it cannot be imagined that the lowering of the centre arch of Westminster Bridge to the extent which I have proposed, can really be an objection of any importance as regards the navigation of the river, while the great object that would be thereby gained by a farther depression of the road-way, to the extent of 18 inches, reducing its inclination to 1 in 40, instead of 1 in 24, as proposed by Messrs. Walker and Burges, would be of the greatest advantage to the traffic over the bridge, as well as to the effect of the new Houses of Parliament when viewed from it, a point which I submit ought not to be disregarded.

Messrs. Walker and Burges state in their letter, as an objection to the form of arch which I have proposed, that the failure of one arch would cause the destruction of all the piers and arches; a consideration which they say is not to be disregarded in a bridge, the piers of which have been so badly founded, that to support them has been a constant expense, and is at this moment a source of considerable anxiety; although they further state, that the works they have in hand, if as successful as hitherto, will render the piers much more secure than they have ever been; they hope, perfectly so. The part of this objection which is founded upon the lateral thrust of arches, will apply with equal force to all arches of a segmental or elliptical form, which are generally adopted in modern bridges, and even to semicircular arches, of the lateral thrust of which I will not affect to suppose Messrs. Walker and Burges to be ignorant, although in the allusion which they make to Labelye's opinion that subject, they leave it to be so inferred. With regard to the other part of the objection, namely, the failure of the foundations, it may surely be assumed that Messrs. Walker and Burges would not have recommended the very serious outlay which is now being incurred in securing them, if they conceived there was any risk whatever of their ultimate failure; but if a possible failure is notwithstanding to be taken into consideration, can a more powerful argument be advanced in favour of a new superstructure, than that the weight upon the piers might thereby be reduced at least one-third?

To Messrs. Walker and Burges' design for a new superstructure I object, principally because it does not accomplish the main objects for which a new superstructure is, in my opinion, desirable, namely, the reduction of the mass so the bridge, and the lowering of the road-way to the utmost practicable extent; neither does it afford any improvement whatever in respect of the navigation of the river; the accomplishment of which objects is, in my opinion, of far greater importance, both for the sake of public convenience and architectural effect, than the style of architecture to be adopted.

As to the principles which Messrs. Walker and Burges consider should govern the nature of a design for a bridge over the Thames in London, I entirely disagree with them; I conceive that the height of the opposite shores and buildings upon them should mainly determine the æsthetical character of the design. If, as in Waterloo Bridge, where the shores are high, one being naturally so, and the other raised, and the road-way is level; where the superstructure of a great public building like Somerset House is wholly above the level of the road way; and where the bridge groups with the substructure of such an important building; the character of the design cannot be too bold and massive; but if, as at Westminster, where the shores are low, and the bridge must in consequence group with the superstructure of an extensive work like that of the new Houses of Parliament; and where the parapet must, in consequence of the height required for the centre arch, assume a curved line, which is an element rather of elegance than of boldness, the character of the bridge should be light and graceful.

Upon the taste of Messrs. Walker and Burges' design for a new superstructure in what they term the "Norman style," I forbear to offer any criticisms in detail, as the conditions which should be observed in a bridge are, in my opinion, wholly at variance with the essential characteristics of that style; nor do I consider it worth while to make any remarks upon their observations relative to points of taste, including those especially which refer to harmony and contrast between the bridge, the new Houses of Parliament, and the neighbouring buildings, as they seem to me to furnish their own comment.

In conclusion, I beg to add, that I still remain of the same opinion, as I expressed in my report to the Fine Arts Commission, as to the necessity of a new superstructure to Westminster Bridge upon the principles therein advocated; and as a favourable opportunity is now afforded of carrying into effect that great public improvement, at an outlay, moderate, when compared with its importance, I trust the Commissioners will not be indisposed to take my recommendations upon this subject into their most serious consideration.

I have the honour to be,
Sir,
Your very obedient servant,

32, Great George Street, CHARLES BARRY.
10th July, 1843.

The Rt. Hon. CHARLES S. LEFEVRE,
Speaker of the House of Commons,
Chairman of the Commissioners of Westminster Bridge.

OPENING OF THE NEW GRAVING DOCK AT WOOLWICH.

THE opening of this stupendous work took place on Monday, 17th July, when this dock was entered for the first time by Her Majesty's frigate *Chichester*, for the purpose of being coppered, &c. Viewed only as a work of mere masonry and architecture, the dock would, in itself, be a most striking object, but when the difficulties required to be surmounted in its construction are considered, it must be acknowledged that the new basin is an object worthy of remark, and a specimen of the perfection to which this particular description of civil engineering is carried in this country. The basin in question is of solid granite, with steps, or what are technically termed altars, on each side, 15 inches to one foot deep, affording facilities for descending to the bottom, and also for props or supports being affixed, thus enabling any vessel, whatever may be her size, to be supported on her keel without injury. The length is 300 feet at the top of the water, 215 feet at the bottom; the width of the basin is 80 feet at top, gradually diminishing as the basin deepens. As it approaches the bottom it presents the appearance of a perfect concave some 26 feet deep. To this basin there are two folding-gates, or locks, extending the whole width of the dock, made of iron and timber doubled, and weighing about 60 tons each; and the perfection with which these gates work, and are adjusted to each other, may be seen in the fact, that though each of them are of the enormous weight of 60 tons, two men, or rather a boy and a man, can move them easily. These gates open to the general basin communicating with the Thames. The dock itself is filled by the river tide, or by a steam-engine working with two 20 horse boilers, which can either fill the dock or withdraw the water in about six hours' time. When the engine is required to empty the dock, the water withdrawn from it can either be discharged into the common sewer, or into the basin, which communicates with the Thames. The engine is situated some hundred yards from the basin, is by Boulton and Watt, and is a beautiful piece of mechanism. The time it takes to empty the dock varies according to the size of the vessel received in it, a large vessel displacing more water than a smaller one. In the case of the *Chichester*, which appeared to us to be of the size of a 46 gun ship, the time taken was about six hours. There is also upon the top of the engine-house a tank holding some 200 tons of water, available in cases of accident, and in

the yard there are also other wells, accessible by pumps, supplying fresh water for the use of the dockyard, the latter wells being perfectly unconnected with the dock itself.

The time occupied in these works has extended over something more than seven years, and the difficulties which the engineer has had to meet and surmount may be judged from the fact that the basin itself is cut through a stratum of peat and another of quicksand, through which percolated a spring which afforded some 800 gallons of water per minute. The whole of these strata were dug through to the depth in some places of 125 feet, and the sub-springing waters were conducted through various channels towards the river. The altars or steps on each side of the dock, which are 24 in number, extend from the top to the bottom of the basin which, viewed from its upper end, presents the appearance of an inverted parabola, and the whole of which is formed of hewn granite masonry; every stone being joggled to its neighbour by pieces of Bangor slate, so that no part of the work can sink in or get out of place; or if it should, then, that all parts of it should sink equally without disturbing their respective bearings and proportions to each other.

The masonry, which is 18 inches in depth, is laid upon concrete seven feet thick. The dock itself is executed from the plans of Mr. Walker, by Messrs. Grissell and Peto, and is calculated to have cost already about 80,000*l.* exclusive of the steam engine.

Taken as a whole, this basin is really a wonderful work, whether we consider it merely as a plain engineering operation, or whether we look at the difficulties which have been encountered successfully. In either case we conceive that great praise is due to Mr. Walker, the engineer, not merely for the general plan of the undertaking, but for the minor details in carrying it out. Taking it for all in all, the work is worthy of the country, it is creditable to those engaged in it, and is calculated to be eminently useful for the public service. —*Times*.

KYANIZING OF TIMBER.

SIR,—In consequence of one or two erroneous statements which have appeared in your Journal, and also on account of a Report to the Treasurer of the Brighton Suspension Chain Pier Company, upon the preservation of timber from decay by Mr. Prichard, of Shoreham, which report contained many mis-statements, which, if not contradicted, may injure the reputation of a very valuable discovery, you will much oblige me by inserting the following remarks:—

1st. It is asserted that sleepers Kyanized five years ago, and in use at the West India Dock warehouses, have been discovered to decay rapidly.—I would state in reply, that Kyanized sleepers have not been used at any of the West India Dock warehouses, but the Anti-Dry Rot Company did lay down at *their own* station, West India Docks, in 1836, some Scotch fir sleepers prepared with very weak solution, *by way of experiment*, and some of these have shown symptoms of decay.

2ndly. It is asserted that the wooden tanks at the Anti-Dry Rot Company's principal yard are decayed.—The tank referred to was made of unprepared wood, as the maker can testify, and was used as a water cistern, and occasionally held solution; only one or two of the boards showed the slightest symptoms of decay, and that on the *outside* alone. Mr. Prichard, it appears, is not aware that a waterproof tank is capable of containing a solution of corrosive sublimate *without waste*; the solution will not penetrate timber laterally, but only from the extremities, and therefore that it is in no way surprizing that a tank containing a solution of corrosive sublimate should decay *on the outside*.

3rdly. It is asserted by Mr. Prichard, that in Shoreham Harbour there is a wailing piece, the very heart of English oak, Kyanized, and in use only four years, which is like a honeycomb, or network, completely eaten away by the *teredo navalis*, and other seaworms.—The truth of this assertion is denied upon the authority of the annexed Minute of Survey and Report from the Commissioners of Shoreham Harbour.[1]

4thly. Mr. Prichard states that he opposed Kyanizing on the ground that in tropical climates it would be as poisonous as the quicksilver mines of Illyria.—In reply to this statement, I would refer to Messrs. Enderby of Great St. Helen's, who built a ship, many years since, wholly of Kyanized wood. It has been three voyages to the South Seas, the crew have returned each voyage remarkably healthy, and we have now in our possession some of the bilge water, which has been analysed, and found to be considerably more pure than on ordinary voyages,

I am, Sir,
Your obedient servant,
TASWELL THOMPSON, Secretary.

[1] We have not room for the Committee's Report further than the following extract.—EDITOR.

"Report, that Mr. Thornton, the Harbour Master, had pointed out five pieces of English oak wailing which the sub-committee had inspected and found as sound, in their opinion, as when first put in, and that Mr. Prichard stated that the piece he alluded to as heart of oak was removed from the pier by himself, but he refused to exhibit it."

REVIEWS.

Applications of the Electric Fluid to the Useful Arts. By Mr. ALEXANDER BAIN. *With a vindication of his claim* By JOHN FINLAISON, Esq., of the National Debt Office. London: Chapman and Hall, 1843.

Controversies on the subject of prior claims to scientific discoveries always involve doubt and pain, but much more so when parties are concerned who have rendered efficient service to the public. Statement is made upon statement, reply upon reply, and the simple truth becomes more difficult to ascertain than before, while personal abuse and personal feelings enter the field to render the contest still more violent and irregular. The main question at issue is, whether Professor Wheatstone or Mr. Bain is the inventor of certain applications of the electro-magnetic power; upon this, several other extraneous issues have been raised, each party accusing the other of piracy, one charging ingratitude and another breach of trust. Under these circumstances a case has been brought forward by Mr. Finlaison, on the part of Mr. Bain, to which we should be inclined to attach considerable weight, if it were not an *exparte* statement, to which we have not yet had Mr. Wheatstone's reply. When it is remembered too that partizanship has displayed itself to a great extent, that the scientific men have enlisted themselves under the banner of Professor Wheatstone, and the natives of Scotland under that of Mr. Bain, the danger of coming to a rash decision is evident. We shall certainly not be so unwise at the present moment. When we recollect the contests between Newton and Liebnitz, Wren and Hooke, Worcester and De Caus, Talbot and Daguerre, Jacobi and Spenser, and so many others, we feel the danger of hazarding a decision. Time is one of the grand elements towards arriving at a correct conclusion in questions of this kind, for it is not until passions are allayed that it is at all prudent to ascend the tribunal of judgment. It must be recollected, too, that there is scarcely an invention or discovery of importance, with regard to which several parties have not been in the field at the same moment, and having at the first blush very strong claims to priority. Under such circumstances, we retreat from the arena; but this we can say, on the present occasion, that whatever may be the result of the present contest, the talent, the invention, and the valuable services of Mr. Alexander Bain, must remain undisputed and unimpaired. His last discovery, it appears to us, cannot be contested, and would alone be sufficient to confer on him high scientific rank. From this part of the pamphlet we shall proceed to give some extracts, with regard to this new and important discovery, which led to the means of dispensing with the galvanic trough, by having recourse to *the earth as a source of permanent voltaic electricity*.

For the purpose of investigating the nature of this phenomenon, Mr. Bain in conjunction with Lieutenant Wright, performed several experiments in the Polytechnic Institution and on the Serpentine River in Hyde Park.

"The first experiment consisted in passing an electric current through the water, by means of a complete circuit of wires laid from one side of the river to the other, with a compound battery of six cells, of about twelve square inches surface on one side of the river, and on the opposite side an electro-magnet of soft iron, with its feeder. On an electric current being established in the wires, it was found that a small portion only reached the electro-magnet; enough, however, to enable it to sustain its own weight. On the circuit being broken, by disconnecting the wires *from the battery*, it was found that the attractive power of the magnet did not entirely cease. The electric current being again transmitted through the wires, the circuit was broken by detaching the wires *from the magnet*, when its attractive power ceased immediately. The experiment was then repeated as at first, and the same result obtained—viz., a very gradual decay of the magnetic power. It is well to observe here, that the feeder was removed from the magnet, and kept from it several minutes; on being again presented to the magnet, it was slightly attracted by it. It was premised that on an electric current being established in one direction, its effects on the magnet might be instantly annihilated by changing the direction of the current; experiment proved this to be the case, and thus pointed out an effectual remedy for the inconvenience, although the cause was still unknown. As it was evident in the foregoing experiment that the greater portion of the electricity was conducted *from one wire to the other by the water*, particular attention was next given to this branch of the subject. A portion of one of the wires forming the circuit was lifted out of the water at several points between the two banks of the river, and the electro-magnet placed in the circuit, when it was found that the current was transmitted by the water from one wire to the other, the greatest portion of the electric current passing from that part of the wires which was nearest the battery. These facts rendered it obvious that water was quite capable of conducting voltaic electricity, provided a

sufficient surface of metal was present to convey the current into and ou of the water. Before proceeding to apply this fact, however, the first experiment was repeated, but with a smaller battery.

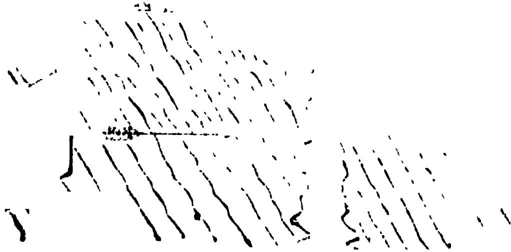
"A copper wire was next laid down on the gravel walk along the north bank of the Serpentine River, from the bridge which separates Hyde Park from Kensington Gardens, to the east end of the river. About three square feet of metallic surface was attached to each end of the wire and put into the river: a galvanometer was put into the circuit at the bridge, and a small Grove's battery at the other extremity of the wire. The electric current passed by the water, and returned by the wire, and with as much power as would have been the case with an ordinary metallic circuit. In this arrangement the magnetic influence ceased the moment the circuit was broken, as it would have done in an entirely dry circuit.

"Reflecting on the foregoing experiment, it occurred to Mr. Bain that the natural moisture of the earth might be a sufficient conductor for the electric current, and with a view to ascertain the correctness of this assumption, a wire was led along a wood-paling extending from the river to a well about a hundred and fifty yards distant; one of the metallic surfaces attached to the wire was put into the river, and the other into the well; the galvanometer was put into the circuit near the river, and the small battery near the well. On completing the circuit, the current passed freely, as in the former experiments, showing that *when sufficient moisture* is present, the earth is a good conductor of voltaic electricity; and that one-half of a voltaic circuit is all that is necessary to be insulated from surrounding conducting matter.

"While reflecting upon these experiments, some few months after they had been performed, Mr. Bain was led to infer, that if a surface of positive metal was attached to one end of a conducting wire, and an equal surface of negative metal to the other end, and the two metallic surfaces put into water, or into the moist earth (the wire being properly insulated from surrounding matter), an electric current of considerable energy would be established in the wire. This proposition was soon tested by an experiment performed in the grounds of Mr. Finlaison (the government calculator), at Algher's House, Loughton, Epping Forest." In a moat distant 150 yards from a pond of water, was placed a plate of about 12 inches surface of positive metal, and in the pond a similar size plate of negative metal, and a galvanometer with a conducting wire connecting the two plates were laid along a gravel walk. "The moment this arrangement was completed, the galvanometer showed that an electric current was passing from the metal in the pond, through the earth to the metal in the moat, returning back again by the wire. The current was of considerable energy, and this experiment was repeated a number of times with unvarying success."

Similar experiments upon a larger scale were tried upon the Serpentine River, in Hyde Park, with equal success.

"These points being satisfactorily established, Mr. Bain next proceeded to make the experiment as shown in the annexed diagram.



A surface of zinc (Z), was buried in the moist earth in Hyde Park, and, at rather more than a mile distance, a copper surface, C, was similarly deposited; the two metals were connected by a wire, suspended on the railing, and on placing a galvanometer, G, in the circuit, an electric current was produced, which passed through the intervening mass of plate from the earth, returning by the wire. In the first experiment, the metallic surfaces being small, the electric current produced was feeble, but on using a larger surface of metal a corresponding increase in the energy of the current was obtained, with which an electrotype process was conducted, and various electro-magnetic experiments performed with uniform success.

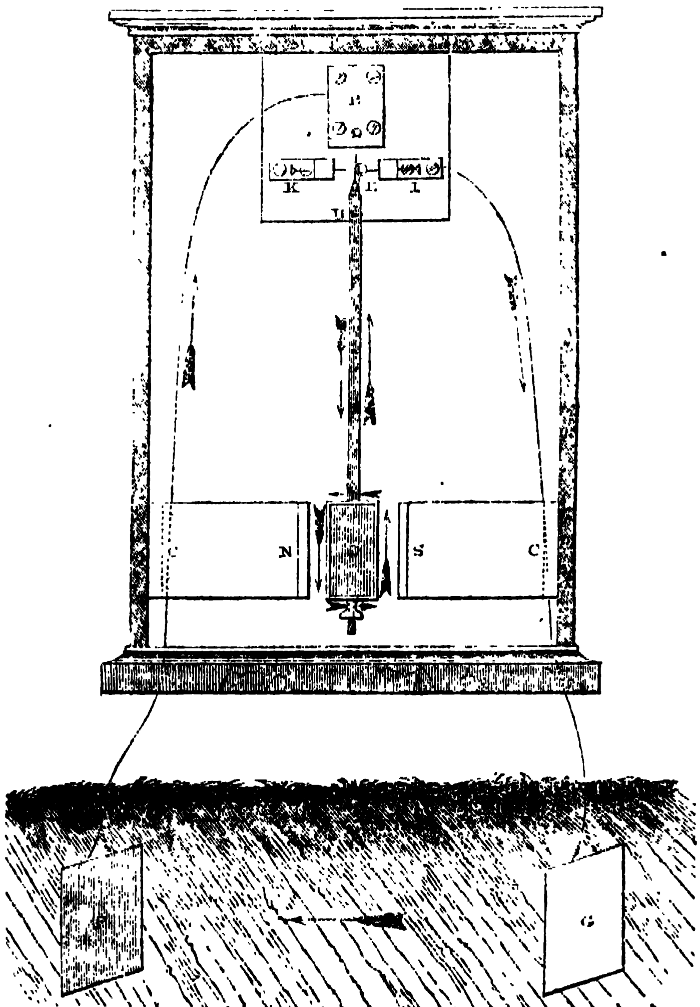
"Subsequent experiments have shown that if two metal plates (a negative and positive) of sufficient surface are sunk in the earth as a battery, and wires led therefrom, electrotype deposition may be effected, and every description of electro-magnetic apparatus worked for any length of time. The most successful results have, however, been obtained by depositing several surfaces of positive metal in the earth connected into a group by wires, from which a conducting wire was led to a series of negative surfaces similarly disposed at a more remote spot. When considerable power is required, this is the arrangement that should be adopted. It is essential to success, that the earth wherein the plates of metal are deposited should be of a moist nature. A current has, indeed, been obtained in dry soils, but of such small energy as to be of no practical utility. This, however, may have been occasioned by the very small proportion of metallic surface with which the experiment was made.

"Such a source of electricity as the foregoing promises to be most extensively useful in the arts. Among other advantages, its simplicity and cheapness are no small recommendations, while the uniform character of its power is of the utmost importance. A battery of this description, under very disadvantageous circumstances, has produced a power which for upwards of six months has been found unvarying." * * *

"If a copper wire, one-sixth of an inch in thickness be imbedded in a bar of boiling asphaltum and sent along the railway (for its better protection) from London to Liverpool—if two tons weight of zinc plates be immersed in the Mersey at Liverpool, and attached to that end of the wire—and if one ton weight of copper be sunk in the river Thames, and attached to this end of the wire, no rational man can doubt that an electric current would be established of ten times the power necessary to work a telegraph."

"Now, in the voltaic circuit in question, it may be a hard matter to say whether the current flies round the coast by the sea, or whether it penetrates the earth superficially. One thing is, however, certain—the experiment is not likely to be tried at the sole cost of the inventor, and it is humbly conceived that the country, which is to be benefitted by the discovery, should incur the trifling charge of bringing it into use. Supposing, however, the very improbable event, that the current, from some unforeseen cause, could not be passed to the distance of 200 miles, it may still be sent, as far as it will go, in relays, connecting these very easily by means which are well known to every practical electrician."

"The following diagram exhibits Mr. Bain's latest improved pendulum, which is moved by a metallic surface, in the moist earth, of no more than four or five feet. It is, indeed, very necessary in these times to publish it without delay, lest the merit of this invention also should be snatched from him by some one or other of the *faiseurs* of the day. Can any man now foresee the important ends to which this little instrument may hereafter be applied? In the ordinary use of it for the measurement of time, diminished friction, and hence far greater accuracy, is obviously secured. Its permanence of action is probably the nearest approach yet made to the impossible



chimera called the perpetual motion. Mr. Bain intends to apply it also to telegraphic purposes, in which its agency secures him improvements of the last importance, for he can certainly, by its means, discard wheels of any and every description, as well as electro-magnets.

"A A is a mahogany case with a glass front; B is a metal bracket fixed to the back of the case, and to which the pendulum D is suspended. C C are permanent steel magnets fixed to the sides of the case in such a manner as that the pendulum-ball D can vibrate freely between the poles of each magnet. The magnets are so placed as that poles of dissimilar names face each other. E is a small platinum ball affixed to a brass stem, free to move to one side or the other, being fastened to a light spindle carried by the pendulum rod at H. The plate of copper F is deposited in the moist earth, from which a wire leads to the bracket B. The plate of zinc G is likewise deposited in the earth, and its wire leads to the piece of metal I. To the lower end of the suspension-spring of the pendulum is attached a wire coated with silk. It is led down the back of the rod (which is wood), and then coiled longitudinally, in many convolutions, around the edge of the pendulum-ball, in a groove previously made for the purpose. It is then taken up the back of the rod and terminates in the bearings of the spindle at H. The action of the engine is as follows:—A constant and uniform current of electricity would be established, and would pass through the earth, the plates and wires in the direction of the arrows, as long as the platinum ball E rests on the platinum pin projecting from the metal I. But if the pendulum is put in motion, suppose that, at first, it were drawn aside until the ball D should be between the poles of the right-hand magnet, the point H being now farther to the right than the ball E, the latter would fall to the left and rest on the pin K until the pendulum took its vibration to the left, when the ball E would fall to the right, and so on continually, the action being produced by the change of the centre of gravitation at each vibration of the pendulum. This action of the ball E lets on and cuts off the flow of electricity at or near the extreme ends of the pendulum's vibrations, so that the convolving wire of the pendulum-ball is attracted and repelled by the magnets at the proper points of its vibrations, and thus a continual motion is kept up for an indefinite period of time."

We shall endeavour next month to draw the attention of our readers to the ingenious printing telegraph of Mr. Bain.

The Inventor's Manual, a familiar and practical Treatise of the Law of Patents for Inventions. By J. TOWNE DANSON and G. DRYSDALE DEMPSEY. London: John Weale.

Several useful works have been published on the law of patents; the object of the present one is to give a clear exposition to inventors and parties interested in patent property, of the modes of obtaining patents, and of making them legally available, without entering into details of a nature merely technical. The authors have brought some new light on various points of the subject; and with regard to the meaning of the word "manufacture," they propose a much simpler definition. After quoting the classifications of Godson, Webster, Carpmael, Rankin, and Holroyd, the authors proceed to observe—

"As these classifications do not assist us in defining the word 'manufacture,' they do not appear to have any practical value to the inventor in defining his claim, or to the public in testing it. For both these purposes the words of the statute, 'any manner of new manufactures,' are amply sufficient, and in every case in which an inventor may have been so ill-advised as to claim a 'method,' or a 'principle,' or a 'process,' and his right has been questioned, the judges have found it necessary to bring him back to the expressive word 'manufacture,' and expound to him, that for the invention of that, and that only, will the law afford him the protection of a patent. Or if a difficulty occurs in ascertaining whether or not the security of a patent is attainable, the solution of it is always found to depend on this simple question, whether the invention will give to the public a new, useful, and vendible result, in short, a 'manufacture;' and not by considering its eligibility to be ranked in the class of 'substances,' 'machines,' 'combinations,' or 'principles.'

"It would be easy to show that many of the tedious questions which have perplexed inventors, juries, and counsel, would have been either avoided altogether, or immediately solved, if the words of the statute had been regarded, without reference to the ingenious definitions given of them."

In confirmation of the view here taken, the authors cite various cases decided by the judges, and then proceed to observe—

"That the complex classifications of patentable manufactures hitherto attempted, are resolvable into the very simple one of *things made* and *things improved*, we shall complete this part of the subject, and prove the sufficiency of the word 'manufacture' to cover all beneficial inventions, by selecting a few of the most striking instances from the number of patents which have been granted nominally for *methods, processes, &c.*, and showing, in each case, what was the 'manufacture' produced."

In support of this definition, quotations are given from several cases, selected from a large number, which the authors contend are sufficient to show how the words of the statute, "any manner of new manufactures," may be applied, to limit the extent of every claim of invention.

The authors now proceed to define who may obtain a patent, which we do not think requires much explanation, as the words of the statute, "the true and first inventor," is amply comprehensive. They next explain on what conditions a patent are granted, and then give the various forms necessary for obtaining and securing it, and conclude by describing the use of a patent as property, remedies at law for defending it against infringement, and what is requisite to be done provided the patent is voidable in part, so as to secure a valid title; all of which the authors have explained very briefly, but quite sufficient for the general reader to comprehend, without wading through long legal reports.

Ancient and Modern Architecture. Edited by M. JULES GAILHABAUD. London: Firmin Didot & Co. Parts 8, 9, and 10.

This series does not diminish in interest, on the contrary, its character is well maintained. In the numbers now before us are contained several interesting plates. That ancient monument, the Acropolis of Tiryns, is well illustrated, and is a good example of the old Cyclopean citadel. It is a remarkable proof of the extensive progress of architecture at this era, that no less than four hundred towns are known to have been surrounded with stone walls of Cyclopean work, supposed to denote the seats of so many Pelasgic colonies. The Acropolis of Tiryns is a gigantic monument, the walls of which enclose a superficies of 197 feet in length, by 59 in breadth. The external wall is in general 19 feet 9 inches thick, and in some parts 25 feet 3 inches. Its height 42 feet 3 inches. The blocks are in some cases from 10 to 13 feet long, by 4 feet 4 inches thick. The vaults of the galleries are considered as probably the most ancient specimens of the pointed arch in Greece. The church of the Invalides at Paris, affords another illustration; its section shows a triple cupola, and an enormous waste of space between the internal and external roof of the nave. The mosque of Al Mowaiyad, at Cairo, is one of those composite buildings in which the early Arabs indulged, showing a Moorish superstructure upon Greek and Roman columns. The harmony, however, of the general design is preserved. The cathedral of Athens is a monument of not less interest, as a specimen of the Byzantine style, with its lantern, and alabaster windows. It is supposed to belong to the Venetian period. The market of St. Germain will be of interest to our numerous readers engaged in the construction of such works in the provinces; the plates show a view, elevation, ground plan, and the details of the roofs. The market is a parallellogram, with an open court in the interior. The dimensions are 302 feet long by 216 broad. The stalls in the Marché St. Germain are 366 in number. In order to enable our readers to compare, we have brought together the sizes of several markets in France and England.

Names.	Length feet.	Breadth. feet.	Area. yards	Cost. £.
St. Germain, Paris	302	246	8254	
St. John's, Liverpool	549	135	8235	40,000
St. Martin's, Paris	328	197	7179	
Farringdon, London	256	164	4664	
La Vallée, Paris	204	151	3422	
North Market. Liverpool	213	135	3195	13,000
St. James's, Liverpool	..	..	3000	14,000
Corn Market, Liverpool	114	60	760	10,000
Market Hall, Birmingham [1]	360	108	4320	30,000

The Halle au Blé belongs to the same class of subjects, and presents the example of a metallic cupola, 401 feet 6 inches in circumference, and 106 feet 7 inches high.

[1] Six hundred stalls.

A Map of the Geology, Mineralogy, &c., of the British Isles and part of France. By J. A Knipe.

The importance of geology, as a practical science, in connexion with Agriculture and Engineering, is now too well appreciated to require any comment; and the value of any accession to our information on this subject, is equally obvious. It is with these views that we now recommend to the patronage of our readers the production of Mr. Knipe, who has exhibited a degree of labour and research, well worthy of encouragement. He has undertaken to describe the geology, mineralogy, internal communications, harbours and ports of England, and the adjacent countries, together with a part of France, availing himself of the most recent information, and the investigations of the most eminent men of science. Thus each part of the map is laid down from the researches of those geologists who have most distinguished themselves in the examination of particular districts, exhibiting their minute observations, and illustrated by numerous sections. For each part the authorities are given, and an explanatory index is added, referring to the most approved classifications and nomenclature, in English, French and German; in fact, the most minute details are to be found in this map which have not appeared in any other: the size is 5 feet 4 inches by 1 feet 4 inches; we should observe that all the railways and canals are shown, the clination of the strata, heights of mountains, mines, levels, &c.

A Series of Diagrams, under the superintendence of the Society for the Diffusion of Useful Knowledge. Chapman and Hall. Part 7.

This number contains the vertical section of a saw frame, elevation of shears for cutting iron, and the details of an eight day clock. Thus the conductors are realizing a most important desideratum, the publication of a popular series of working drawings of machines, affording instructions at the same time to the workman and draughtsman. We are pleased too to see that a small work on mechanics is to be published to accompany the diagrams. We can fairly say that a series of greater importance to the working man has rarely been published. We should observe that one of the advantages which this work possesses, is, that it will enable classes to be formed in the provincial mechanics' institutions for the study of mechanical drawing, an object for which many working men are chiefly induced to become members of such societies.

Photogenic Manipulations. By George Thomas Fisher, Jun. London: George Knight and Sons, 1843.

This is one of the most comprehensive of the many little treatises which have been published on the manipulation of the new arts of design. Coming from the hands of the Messrs. Knight, well known for the attention they have paid to practical science, shows that this tract has been carefully compiled. It takes up the subject in all its branches, including Calotype, Chrysotype, Cyanotype, Photography, Ferrotype, Anthotype, Daguerreotype and Thermography.

The British and Foreign Traveller's Guide. Sherwood & Co.

This little work, which appears to have been compiled with great care, is of the highest value to the traveller, who, indeed, ought not to be without a copy; it gives the times of starting, the fares, and route of all the English and Continental railways, and steam vessels, besides some highly useful and necessary information as to exchanges, and the value of foreign measures and money.

NEW CHURCH—STRETFORD NEW ROAD, MANCHESTER.

This beautiful church was designed by Messrs. Scott and Moffatt of London. It is built in the early English style of architecture, which prevailed in this country during the reign of Henry III. To give any thing like a perfect description of the building in a limited compass would be impossible; I shall, therefore, content myself with a description of its most prominent features. The church is cruciform in plan, and is composed of nave, ailes, transepts, and apsis or chancel, and a tower at the west end. The dimensions are as follows:—length of nave 65 feet, breadth of transepts 21 feet, and length of chancel 17 feet. The total internal length, including the thickness of the chancel arch, 108 feet. Length of transepts 68 feet, breadth of nave 24 feet, breadth of ailes 11 feet 10 inches, diameter of the pillars 2 feet 2 inches; total internal breadth 52 feet, height of pillars 15 feet 4 inches. There are four arches on each side of the nave, struck from centres at the extremities of the base of an equilateral triangle. The height of the nave, including pillars, arches, and clerestory 40 feet, and the total height up to the ridge of the roof 58 feet. There are no galleries, except a small one at the west end of the nave, the greater portion of which is in the tower; and the front forms a semi-octagon, perforated with small trefoil headed arches, which are supported on small pillars, having base mouldings and capitals: there are stone corbels left on the pillars at the west end for the support of the breast beam of a larger gallery, to extend the whole breadth of the nave and ailes; but it is to be hoped that such a gallery will never be built, as it would totally spoil the internal effect of that end of the church. The body of the church is fitted up with open stalls or benches, and it is sincerely hoped that they will always remain open, for pew doors would effectually spoil the architectural effect of the interior of the church.

In describing the exterior of the church, the tower first claims attention: it is composed of five stages or stories: that on the ground floor forms the west entrance into the church, through a noble and majestic doorway, of good proportions. Its jambs are enriched with small pillars and hollow mouldings; the head consists of a pointed arch, composed of several rich mouldings; the whole being crowned with a good bold label mould. The next stage forms the organ gallery, which is lighted by a lofty lancet window of one light, having on each side a lancet panel, so managed as not to convey the least idea of a blank window, and the whole enriched with small pillars. In the next stage, the walls are perforated with quatrefoils of most beautiful design, and executed in a masterly manner. The next stage forms the ringers' chamber, and being similar to the second, will not need any further description. The fifth stage forms the bell-chamber, and is most beautifully designed; the windows are of two lights under one arch, the head of which is filled in with a foliated circle of four cusps. The corners of the tower are flanked with octagonal turrets, five heights of which are disengaged; and two faces of each turret are again flanked by a buttress rising three stages up the tower. The turrets finally terminate in very richly composed pinnacles, which are also octagonal in plan, and have small detached pillars at the angles supporting small arches, the points of which die under the drip of the pinnacle. Each pinnacle is crowned with a finial, and further enriched by a rib at each angle. The walls of the tower are crowned with an unbroken parapet, the breast resting on small trefoil headed arches, and the water table supported on small corbels. Viewing the tower as a whole, whether by itself or in connexion with the rest of the building, it is certainly one of the finest towers of its class in Great Britain, ancient or modern. Yet it has one fault, whether seen in elevation or perspective, viz., that the pinnacles are considerably too large.

The next thing to be noticed, is the porch on the north side, standing out from the west bay of the north aile; the outer arch is very highly enriched with a variety of beautiful mouldings, and two rows of what is called the dog-toothed ornament; there are three small pillars to each jamb, with base mouldings and enriched capitals. The arch is surrounded with a label, the inner sweep of which is enriched with the dog-tooth ornament, of a much smaller size than those just mentioned. The corners of the porch are flanked with handsome buttresses, terminated with rich canopies. The gable of the porch is surmounted with a beautiful cross; the ceiling consists of stone groined arches, with very beautiful ribs at the angles. The next portion of this side of the church claiming attention, is the north transept, the front of which is perforated with two lancet windows coupled together, the spaces between them and the corner buttresses being filled in with narrow lofty panels, and the heads of both windows and panels form an unbroken series of four arches, crowned with labels, and resting on beautiful small pillars. Above these arches is a wheel window, divided into six compartments, by radiating pillars diverging from the centre. On the point of the gable above this window, is fixed a very handsome cross, enriched with a crown of thorns. The angles of the transept are flanked with buttresses, and crowned with octagonal pinnacles, similar in design to those on the tower. The chancel forms in plan five sides of an octagon, with a buttress at each angle. Connected with the south bay of the chancel is a small but handsome vestry, with an outer door on the south side, and two small trefoil headed windows on the east. There are two inner doors, one opening into the south transept and the other into the chancel. There is nothing in the south side of the church which requires particular description; all the windows, both of ailes and clerestory, are coupled lancets, two to each bay: the chancel windows are of one light. The

roofs of the nave, chancel, and transepts are covered with ornamental blue tiles, which have a very good effect. The hips of the chancel roof, and also the ridges of the clerestory and transept roofs, are enriched with a trefoiled leaf ornament. The roofs of the ailes are covered with blue slates. Having thus given a general description of this beautiful church, I shall once more enter it by the south door, and the first object that will present itself to view, is the font on the left hand of the entrance, and at the west end of the south aile. It is so exceedingly rich and beautiful, both in design, material, and execution, as to baffle any written description. On advancing further into the church, and turning to the right down the middle passage, (erroneously called aile,) no one alive to the sense of the beautiful, could avoid being deeply impressed with a lively sense of the architectural fitness of expression, and of the grandeur and beauty by which he would feel himself surrounded. If he looked up to the arches of the nave, he would be struck with the triumphant and dignified boldness of expression by which they are characterized: looking still higher, he would behold the open roof of timber, undisguised by the painter's brush, telling its own simple honest tale. Advancing still further eastward, he arrives in the transepts, where his attention will be caught by a semi-octagon stone pulpit, partly copied from an ancient one still existing in Beaulieu Church, Hants., although inferior to it in several respects. The latter is pure in all its details, but unfortunately this is not so; for instance, there is a row of square quatrefoils round the base of the pulpit, which are decidedly of Tudor character, and which are so very paltry and insignificant, as totally to spoil the whole design. But this is not its only fault: the effect is further injured by the small, shallow, and poverty-stricken foliated spandrils between the arches; and another great and unpardonable fault is the tasteless and unphilosophical application of the four small pillars (on which the pulpit appears to rest) rising out of a bunch of foliage, and appearing as if in the act of falling down. The next object claiming attention, is the groined ceiling over the altar, which is most beautiful in design: the ribs spring from small pillars of stone, placed in the angles of the chancel, and the whole groining has the appearance of being of the same material.

Manchester. JAMES HADFIELD.

STEAM NAVIGATION.

THE BENTINCK STEAM-SHIP.

This spendid vessel was built for the Peninsular and Oriental Steam Company, at Liverpool, by Mr. Thos. Wilson, and furnished with engines by Messrs. Fawcett and Preston. She is a companion to the *Hindostan* and destined for the same purpose, to convey the mails between Suez and Calcutta, Madras and Bombay. She is nearly similar in dimensions, model, and power to the *Hindostan*, as follows.—

Length of keel	220 feet
Length aloft over all	250 ..
Beam, within paddle boxes	39 ..
Depth from spar deck	31½ ,,
Burthen, including spar deck	2020 ..
Engines (2 of 250)..	500 horse power.
Diameter of cylinders	78½ inches.
Stroke	8 feet.
No. of strokes per minute	15 ..

The vessel is rigged in the usual manner of large steam ships, as a three-masted schooner, and her standing rigging is of Smith's patent wire rope. The spar-deck forms a fine and uninterrupted promenade; and on each side the quarter-deck there are broad seats covered with mahogany, resembling ranges of sofas, which also form bins. The state saloon is about 32 feet square, being the whole width of the vessel at the stern, and is approached by a wide corridor, at the end of which a handsome flight of steps leads to the right and left at the top on to the deck; on each side of the corridor are ranges of state cabins, and at the end entering from the stairs, is the ladies' cabin on one side, and stewards' room on the other. The whole replete with every convenience. The decorations were designed and furnished by Mr. Bielefield, of London and Liverpool, those in the state saloon consist of a series of ten interesting views from Affghanistan, beautifully enameled on slate by Steedman; the frames of these are of Bielefield's papier maché, arched at the top; with a lion's head, and alternately a neptune's, with a festoon of flowers over each picture, these are all guilt, and highly relieved: the wood work or ground is grained satin-wood, and between the pictures are pilasters of slate, enamelled, to imitate vein marble, with enriched gilt caps, a gilt moulding runs all round the saloon, and on the partition there are four Corinthian columns, one on each side of the two sideboards, and one also on each side the rudder-case, where, on the returns, are two finely executed bas reliefs of "night and morning," executed also in Bielefield's papier maché, after those gems of art by Thorwalsden. The ceiling is simply divided into long panels, with plain mouldings, and the ends of the timbers supported by enriched trusses etched with gold. The prevailing colour of the ceiling is French grey. The mizen-mast is enclosed by a massive fluted Doric column, of wood painted in imitation of veined marble; and a similar but smaller column is placed to enclose an iron one in the center of the entrance to the corridor. The corridor consists of a range of Ionic pilasters, painted in imitation of veined marble, and highly polished, supporting a plain cornice; in the floor, and immediately under a long sky-light is a large well-hole, with mahogany hand-rail and iron ballusters, which lights and ventilates the lower deck, which contains several other state cabins or dormitories.

The ladies' cabin is fitted up with paintings enameled on slate, by Heedman, after Matteau; the subjects are in his usual light and elegant style of garden and love-tending scenery, with a variety of interesting figures pourtraying the tender passion. The frames consist of an enriched bead with centre ornaments; on the pilastars are pendants of flowers in high relief, and an enrichment composed of palms, leaves, and flowers, run round the frieze. The whole of the ornaments are chastely finished in white and gold; and a large looking-glass, judiciously placed, is ornamented with a frame similar to the pictures. The wood-work is grained satin-wood, and the tint of the ceiling is finished French grey. This room has been curtailed of its fine dimensions by a passage having unnecessarily been taken off for an adjoining berth—the partition of which cuts a slice off from the skylight, and ruins the appearance of the ceiling.

The adaptation of Bielefield's papier mache, for the decoration of steam vessels, is now becoming general, and we are happy to bear testimony to its great advantage over every other material for this purpose. The *Hindostan* was enriched with it, though in a very different manner, and has stood the severe test of a hot climate, without any deterioration; one of its superior characteristics being its resistance to vermin—neither worm nor any other insect, heat nor damp, so far as present experience proves—will affect it; and its durability is undoubted. The state panels are also well adapted for decoration, the highly enameled surface brings out the colour of the paintings with surpassing brilliancy, and the rigidity of the substance renders it unliable to warp.

There is a spacious fore-cabin and a lobby, communicating with the principal corridor to the forecastle. On the lower deck, fore and aft, are many other state rooms or dormitories, all fitted up with the greatest attention; and in every part concentration of comfort and convenience seems to be scrupulously studied.

The ship is divided by iron bulk-heads into five compartments, giving her great safety in case of accident, and there are large cisterns for water, hot and cold baths, improved warming apparatus on the worm-tub principle, and every other essential to make her one of the most complete and efficient steam vessels ever produced, and much credit is due to the marine-superintendent, Mr. Shaw, for the very able manner the works have been executed under his vigilant and experienced eye.

TRIAL TRIP. On the 6th of July the *Bentinck* left the Coburg dock, and proceeded on a trial from Liverpool to Holyhead. There were on board her Commander, Captain Kellock, Mr. Shaw, Mr. Wilson, the builder, Mr. Fawcett, and a few other gentlemen. She started at 6 o'clock, the wind blowing fresh from the westward.

The following is a statement of her progress:—

GOING.	RETURNING.
At 6h. 10m. abreast of the Rock	At 2h. 10m. abreast of Point Lynas.
9h. 55m. ,, ,, N W Buoy	5h. 15m. ,, ,, Light Ship
12h. 15m. ,, ,, Holyhead	6h. 4m. ,, ,, Rock Lighthouse.

Making the trip out and back upwards of 130 nautical miles in 11 hours and 56 minutes ... r speed was occasionally 12 knots, she was found remarkably easy, the eng... s making 13 to 15½ revolutions per minute.

On the 17t... lt she proceeded to Dublin, from thence to Southampton, and we prest... , ere this, has taken her departure for the east.

THE "GREAT BRITAIN" IRON STEAM SHIP.—This vessel was launched on Wednesday, July 19, in the presence of Prince Albert and many distinguished guests. We have frequently noticed this vessel during her progress, but we will now give a general description to our readers. Burden, 3,500 tons; power, 1,000 horse; length, from figure-head to taffrail, 322 ft.; length of keel, 289 ft.; extreme width; 150 ft. 6 in.; depth of hold, 32 ft. 6 in. She has four decks, the first or upper deck is flush, 308 ft. in length. The second deck consists of two promenade saloons: the aft or first class is 110 ft. 6 in. by 22 ft., and the forward or second class 67 ft. by 21 ft. 9 in.; they are well lighted and ventilated. The third deck consists of the dining saloons, the grand saloon being 91 ft. 4 in. by 30 ft., and the second class or forward saloon 61 ft. by 21 ft. 9 in. These saloons are all 8 ft. 3 in. high, and surrounded with sleeping rooms, of which there are 26 with one bed, and 113 with two beds, giving 252 berths; an improvement has been introduced which affords, by means of passages, much greater privacy than in any other vessel. The fourth deck is for cargo and coals. Under this deck, in the after-part of the ship, is an iron fresh water tank, and in the fore-part is an air chamber from the boiler to the fore bulkhead. The forecastle is appropriated to the officers and sailors; mess-rooms, berths, sail-rooms, &c., are underneath. The middle part of the vessel, from the bulkhead of the fore-part to the bulkhead of the after-part, a space of 80 ft., is occupied by the engines, boilers, engineers'-room, and cooking department, which is over the boilers. There are three boilers capable of containing 200 tons of water, heated by 24 fires, and 4 engines, each of 250 horse power. The cylinders are 88 inches in diameter, which stand in pairs opposite to each other, at an angle of 60° to work the shaft of the propelling gear. The chimney is 8 ft. in diameter and 39 ft. high. She has six masts, the highest of which is 74 ft. above deck. She will carry about 1700 square yards of canvas, rigged with Smith's wire-rope. The hull is divided into 4 water-tight bulkheads. She will be propelled by the Archimedian screw, on the plan of the patentee, Mr. F. P. Smith. Upwards of 1500 tons of iron have been used in her construction, and that of the engines and boilers. Her draught of water when loaded will be about 16 ft., and her displacement of water about 3,000 tons. The plates of the keel are from ¾ to 1 inch thick, and all the other plates are about ½ in. thick. She is clinker-built, and double rivetted in the longitudinal laps. The ribs are framed of angle iron 6 in. by 3½, and are about 14

in. apart in the middle, gradually increasing to 18 and 21 inches, so that her sides are but 7 inches thick. The boiler platform is of plate-iron, supported upon ten iron keelsons, the centre ones being 3 ft. 3 in deep. At the engine-room, for the purpose of additional strength, there are 9 intermediate double ribs, and 16 additional transverse ribs. The joists for the support of the several decks are bars of 3-inch angle iron, with a joist bar of 5 inches by ½ inch rivetted on the side. The distance of the joists are about 2½ feet. The deck planks are fastened to the angle iron by screws from below, and firmly secured at each end to the vertical ribs, which affords a support to the sides, in resisting both external and internal pressure, and are supported lengthwise by longitudinal beams and stanchions. To preserve the hull from springing horizontally, there are diagonal tension bars placed between the angle iron bars and deck planks. The wrought-iron mainshaft was manufactured at the Mersey Iron Works, and is the largest ever constructed, weighing about 16 tons. Her pumps will be worked by machinery, and will be capable of throwing off 7000 gallons per minute.

The Royal Steam Yacht Victoria and Albert.—This vessel, the particulars of which we gave in the last June number of the Journal, p. 216, made an experimental trip down the river on the 18th ult; when off Sheerness, Commander Smith tried the speed of the vessel by the log and found it to be about 12 knots or nearly 15 statute miles per hour, the engines at the time making 18 strokes per minute. Her engines are collectively of 400 horse power; they reflect the highest credit upon Messrs. Maudslays and Field, the eminent engineers, for the superiority and beauty of their workmanship; they are upon the direct action-principle, with double cylinders, as patented by Mr. Joseph Maudslay and Mr. Joshua Field and described in the Journal, Vol. iii., p. 73, accompanied by engravings. Although this was only the first trial, the engines performed their duty with a smoothness and ease which showed how correctly they had been fitted and applied to each other, and worked so perfectly, that scarcely the least motion could be felt above the engine-room, and not the slightest symptom of tremulous motion. As a whole, they are superior to any they have hitherto made, as with them are combined every really valuable invention in that department of the application of steam-power in the royal or mercantile navies of this or any other country. They have brine or change pump to prevent the deposit of salt when using sea water, refrigerators to cool the water by extracting the heat from it before it goes overboard, expansion gear by which the steam can be used more economically; but the boilers produce an ample quantity for full speed without this resource. The engines are compact and occupy but a very small space in the vessel, compared with their great power to move paddle-wheels 10 feet 6 inches broad and 31 feet diameter, including the feathering boards. The engine-room is surrounded by water-tight bulkheads, and not the least heat is communicated from the furnaces to any other part of the vessel, and their presence is not perceptible in the rooms adjoining them. The vessel is now at Sheerness, and is expected to be completed in the course of the present month, and ready for sea. We hope to be able shortly to give full particulars of both the vessel and her engines.

British Steam Frigate "Penelope."—This extraordinary ship, which has created so much interest in the nautical world, by being cut in half and lengthened 63 feet amidships, and transformed from a sailing to a steam frigate, is now ready. The engines are by Messrs. Seaward and Capel. There are two of them, conjointly being nearly 700 H.P., although the nominal power is only 620 horse, the velocity of the piston being taken at 220 feet per minute. The diameter of the cylinder is 92 inches, and the length of stroke nearly 7 feet. Every part of the engines and boilers is made adequate in capacity and strength for 700 H.P. The engines are made upon what is called the direct-action principle, and upon the same plan as the engines of the *Cyclops, Gorgon*, and other steam frigates in her Majesty's steam marine. The condensers are made upon the tubular plan of Mr. Samuel Hall's patent, there are two of them, each containing 7000 tubes, each 6 feet 8 inches long. The cold water is forced through the tubular condensers by four large double-action pumps, worked by rods connected to the air-pump cross-head. The cylinders have four distinct slide-valves, two for the admission of steam, and two for the escape of the steam to the condensers, and the gear for working the slides is so arranged that the admission of steam into the cylinder may be cut off at one-third or three-fourths of the stroke, or at any intermediate portion. The diameter of her paddle-wheels is 31 feet. There are four boilers on the tubular plan, each having five fire places. They are arranged lengthways in the vessel with the fire places (10 of a side) facing the sides of the vessel, so that the two stoke holes or firing places are, one on the starboard and one on the port side of the vessel. In a recess formed between the two foremost boilers is the step for the main mast, which consequently stands nearly in the centre of the engine and boiler room. The chimney is placed at the after end of the two after boilers at a distance of 17 ft. in the clear abaft the main mast. The boilers have each separate safety valves, shut-off valves, feed pipes, and other apparatus, so that any one, two, three, or the whole four can be used at the same time. The total weight of the machinery, including the paddle wheels, the boilers, and the water in the boilers, is stated to be 435 tons: each of the paddle shafts weighs 11 tons, and is 22 inches in diameter. The engines are furnished with a disconnecting apparatus, by means of which the paddle-wheels, one or both, can at any time be disconnected from the engines. The chimney of the boiler is arranged like a telescope funnel in two parts to slide into or shut up one within another. She will have three masts, and be rigged in every other respect as a sailing vessel, with the exception that the yards connected with the mizen mast will be struck, and only hoisted when required to be used. *A Trial of her Speed* took place on Thursday, 29th June, when she went down the river as far as Queenhithe; during her trial the paddle-wheels made 16 revolutions per minute: and her speed is reported to have been between 10 and 11 miles per hour. A second trial took place on the following Saturday, when some of the Lords Commissioners of the Admiralty attended; in trying her speed over the measured mile, which was repeated four times, her maximum rate is reported to be 13·8 miles per hour with the tide, and her minimum speed 10·3 miles per hour. On her return she performed the distance, from Erith to Blackwall, of 11 miles, exactly within the hour, the tide being against her.

The Mermaid.—On the 20th ult. the *Mermaid*, the vessel of which we have heard such favourable accounts, passed through London Bridge in the morning and reached Woolwich Dockyard half an hour afterwards. We understand that she is to be fitted for foreign service immediately, and the voyage out will afford an excellent opportunity of testing her qualities as a sea boat. The experience already acquired with the *Archimedes*, the *Great Northern*, and the *Napoleon*, a beautiful French corvette, has shewn their superiority over the old and cumbersome paddle-wheel system. The *Mermaid*, we understand, is fitted up with two beautiful engines, with a propeller upon a new principle, and having been repeatedly tried at the measured mile, down the river, has been found to go thirteen miles through the water. She has gone from Sheerness to Blackwall, with tide, in two hours and three-quarters, the distance being forty-two miles; and the fact of her having beaten, severally, the fastest boats on the river, mounted with paddle-wheels and engines of a superior power, has completely set the question at rest as to the superiority of the stern propeller over the paddle wheels, and over every other description of propeller hitherto tried. The *Archimedes* and *Great Northern* never exceeded 10 miles an hour, unaided by sails. The *Napoleon* is said to have gone 12 m. in the hour, and the French Government are so elated by the success of this vessel, that they have already ordered others to be constructed. *Dimensions of the Mermaid*:—Length of vessel 130 ft; breadth, 16 ft 6 in.; depth, 9 ft.; tonnage, 164; power of each engine, 45 horses; weight of engines, boilers, &c., 46 tons; speed, 13 miles. The propeller is of cast-iron, 5 ft. 8 in. diameter, according to Mr. Rennie's plan.—K.

"Herne" Steamer.—This fine vessel, built of iron for the Herne Bay Steam Boat Company, by Messrs. Ditchburn & Mair, and furnished with engines by Messrs. Boulton, Watt, & Co, is now running between Blackwall and Margate, and performing remarkably quick passages. The following are particulars of her construction:—Length between perpendiculars, 155 ft. 6 in. breadth of beam, 21 ft. 6 in and depth in hold; 10 ft. burthen 355 tons. Power two 60-horse engines; cylinders 43½ inches diameter, 3 ft. 6 in. stroke; paddle wheel 18 ft. 6 in. diameter by 11 ft. over, depth of boards 16 in., and 20 in. each. Boiler of the tubular kind. Draft of water, 6 ft. 2 in. Immersed section, 102 ft. The first passage made on the 27th June, was against the tide to Gravesend, the remainder with ebb, the wind light and against. Starting from Brunswick Wharf at 12 h. 3 m., reached Gravesend by 1 h. 27 m., equal 1 h. 24 m., distance 20 miles, equal 14·3 m. per hour. The entire passage was accomplished in 3 h 50 m, being at the mean rate of 15·7 miles per hour, the engines averaging 29 strokes per minute. The return passage on the 28th, was made with the flood, starting from the bay at 7 h. 38 m. wind N.E., reaching Gravesend at 10 h. 3 m. and Brunswick Wharf at 11 h. 14 m, being 3 h. 36 m. for the whole distance, equal 16·7 miles per hour. The tide from Gravesend to the Brunswick Pier was about as much in favour as the run was against; as no trial at the measured mile was made, the average of the above will give nearly the speed in still water, viz. on the 27th, from Brunswick pier to Gravesend against tide, in 84 m. equal 14·3 miles, from Gravesend to Brunswick pier, with tide, in 71 m. equal 15·6 miles speed in still water, with an immersed section of 102 feet. Since then she has frequently performed the distance between the Brunswick pier and Gravesend in 67, 65, and 63 minutes with the tide, and her passages to and from the Bay average 3 hours 45 minutes. The consumption of coal is moderate for a boiler of the tubular construction, being under 5 lb. indicator per horse per hour.

MISCELLANEA.

Beale's Patent Rotary Engine.—At the Society of Arts, on Wednesday evening, 14th June, Mr. Whishaw (the secretary) read a paper "On the New Rotary Engine," invented by Messrs. I. T. & B. Beale, of East Greenwich, (*Journal*, vol v. p. 181.) The engine described by Mr. Whishaw is one which is constantly at work on Messrs. Beale's premises, at East Greenwich. It consists of an iron case 14 inches diameter, and 9½ inches in thickness. It was stated that it drives a surface-lathe, weighing 24 tons; a planing machine, 30 tons; two smaller planing machines; three drilling machines; a cog-cutting and key-way cutting machine; twelve large self-acting lathes; 250 feet of shafting; a two-foot circular saw; a shaping machine; a punching and shearing press, capable of punching thirty holes per minute; two screwing machines; a fan, giving 1800 revolutions per minute; and a twelve inch air-pump. The boiler is of the common egg-shaped description; and, for the performance of the above work, 560 lb. of coal is used in ten hours. Mr. Beale has an iron pinnace, fitted with one of his patent engines, same size as the foregoing; she is 38 feet long, 8 ft. 6 in. beam, and 4 ft. deep, drawing, at midships, 2 feet of water, and goes nearly ten miles per hour through the water, although the lines of the boat are greatly at variance to the acquirement of a high velocity, being intended for a man-of-war's pinnace, and having a midship section equal to nine superficial feet under water; she is double bottomed, which forms a condenser to the engine, which is supplied by one of his patent boilers—a cylinder 3 feet in diameter, and in which is placed 296 vertical tubes, half an inch in diameter, and 39 inches long, and the height from ash-pit to dome cover does not exceed 5 feet; she is propelled by four segments of a screw, placed upon an open-ended cylinder, and is 24½ inches in diameter. Several members of the Society of Arts made an experimental trip up the river, and completely proved the superior power of the engine, while the extraordinary facility with which the motion can be reversed, by instantly converting the induction into the eduction pipe and *vice versa*, is of the utmost importance in the traffic of a crowded river.

A new Gas Light.—MM. Rouen and Busson, of Paris, are the patentees of a mode of lighting by means of a self-generating gas. The substance employed is coal naphtha, an essence obtained from the distillation of the coal

tar, which is one of the products of the distillation of coals for gas-lighting. The mode by which they obtain a more perfect combustion of the naphtha than before reached, is simple. They contrive, by the apparatus of the lamp or burner, that the gas should be projected to some distance in the air before it takes fire, there being, however, within the tube of the burner, a constant flame, which serves the double purpose of igniting the gas projected from the openings of the burner, and by its heat, in decomposing the naphtha with which the lamp is supplied, generating new gas for continued combustion. The gas, being consumed at a short distance from the burner, is thoroughly supplied with air, and this free supply causes perfect combustion, and a brilliant light without smoke; but it may be presumed that, as the gas escapes from the burner before it is in a state of perfect combustion, the smell is more offensive than it would be if consumed at the immediate orifice. MM. Rouen and Busson estimate that the use of this light is attended with an economy of five-sixths as compared with oil, an equal quantity of light being furnished at a sixth of the expense.

Premature Rise of the Nile.—A very remarkable anomaly has been observed this year in the periodical flux of the Nile. From time immemorial the first day of the rise of the Nile has ensued soon after the summer solstice, and at Cairo the phenomenon has usually taken place some time between the 1st and the 19th of July; this year, however, there was a rise of the river on the night of the 5th of May, consequently two months earlier than usual. This rise continued only four days, after which the water fell, and it still continues falling as it always does until the period of the summer soltice. History affords no example of so early a rise of the river, and only a few instances are recorded of a second rise taking place shortly after the first. One of these instances occurred in the reign of Cleopatra and the other in the year 17·7.—*Cologne Gazette.*

Rise and Fall of the Mediterranean Sea.—A singular phenomenon appeared in the harbour of Valetta on June 2, the water suddenly rising to the height of three feet, overflowing the works of the new dry dock; it almost immediately fell five feet and a half: during this period, a very strong current was running out of the harbour, which the boatmen could scarcely stem. It is supposed this circumstance must have occurred through some earthquake at a remote distance. We hear that at Tripoli in Barbary, several severe shocks have been felt.

Legal Decision regarding Well-Sinking.—In the Court of Exchequer Chamber in Error, on Wednesday, May 19, a judgment of considerable importance was pronounced by Lord Chief Justice Tindal, in the case of "Acton v. Blundell." Within twenty years before the commencement of the action, the plaintiff had sunk a well, and the water which it collected was sufficient to work his mill; but in 1837, the defendant dug a coal-pit three-quarters of a mile distant, which, eventually, drained the well dry, and, therefore, an action was brought to recover compensation. On the trial, the judge told the jury that if the defendant had dug the pit in the manner which was usual in working and winding a mine, he was justified by law in what he had done; and the jury found for the defendant. A bill of exceptions to this charge was presented, which had, subsequently, been argued, but the Court now decided that the summing up was correct. The Court were of opinion that the case should be decided on the principle of the rule which gave to the owner of the soil everything under the surface of it; and that if the plaintiff had suffered loss by the exercise of the defendant's right, it was a loss which was *damnosum non injuriosum*, and for which no action could be maintained. The Court, therefore, unanimously gave judgment for the defendant.

Galvanic Battery.—The battery lately used for the explosion of the Royal George was composed of 20 plates of amalgamated zinc and 10 of cast-iron, on the same principle as Mr. Davidson's battery, with which he exhibits his interesting electro-magnet experiments at the Egyptian hall, Piccadilly. Two batteries being judged necessary, another was made of the same number of plates and of the same size, that is, 7 by 10 inches square, but using copper instead of iron as had been done in the plate battery of Dover. On comparing them by the voltameter, the zinc and iron battery was found much more powerful than the zinc and copper battery of the same dimensions, but contrary to expectation, on combining them into one battery, they neutralized each other instead of doubling the power of either, which would have been the case if two voltaic batteries of the same sort had been thus combined.

Electricity of Water.—An interesting and highly important discovery has been made by Professor Faraday during his investigation of the hitherto supposed electricity of steam. At the evening sittings of the Royal Institution, on Friday, the 9th June, a paper was read on the subject, which with some beautiful experiments, convinced his auditory of the fallacy of some important points in the opinions recently held on electrical science. It has been laid down as a principle upon which important theories have been based, that electricity is produced by the evaporation of water into steam, but Mr. F. has shewn that not only has steam nothing to do with it but that the least vapour in contact with the water prevents the production of the electric fluid, and that water alone, pressed rapidly through a tube, produces the effect hitherto supposed to belong to steam; it being, however, essentially necessary that the water should be pure, even that supplied to our houses for domestic use not answering the purpose; distilled water, however, is now proved to be the most excitable of all electric bodies, while the smallest addition of any extraneous substance will reverse the state of the fluid from negative to positive, and *vice versa*, or destroy it altogether. Its intensity was shewn to be very great, by charging Leyden jars, and drawing sparks from the boiler sufficient to light a jet of hydrogen gas. Mr. Faraday contends that steam, or its action, has no connection with the production of electricity, or thunder and lighting, as there is no water on the surface of the earth sufficiently pure, the evaporation of which could have the effect. The principles propounded in this lecture have excited much interest in the scientific world, particularly among electricians, as the establishment of this theory is so opposed to formerly received opinions, and quite upsets the generally understood *rationale* of engine-boiler explosions.

The Breakwater Lighthouse.—This valuable addition to the public works in our port is now fast approaching to completion. During the past week the third story of the building was completed, so that the oil-room, the store-room, and the living-room are now up. The fourth room, which will be the sleeping appartment, is in a forward state, nearly the whole of it being dry set at the Breakwater Quarries at Oreston. Owing to the great inconvenience experienced from the large number of persons who visited the breakwater and lighthouse, it was found necessary, in order to prevent the constant interruption consequent upon their visits to the latter, to suspend the admittance of the public for the present, but as the several remaining parts of the edifice are put together at the quarries, those persons who may be desirous of inspecting the workmanship may gratify their wish by a visit to the latter place.—*Plymouth Times.*

Dr. Spurgin's Patent Hoisting Machine.—A new machine for raising bricks and other materials to the top of the scaffolding, has just been constructed, and is now in use by Mr. Cubitt, at the houses building at Prince Albert's gate. The hods, baskets, &c. are hooked to a chain ladder, which turns over a wheel at the top of the building; and when emptied, they are sent down by the descending chain. One man is sufficient to work the machinery, so that a vast saving of time and labour is attained. Messrs. Grissell and Peto have also adopted it, and have it in use at the New Houses of Parliament. Dr. Spurgin is the patentee, and M. Journet, a French engineer, has purchased from him the universal licence to carry the invention into operation.

Paris.—The building of the large cellular prison, in the Faubourg St. Antoine, is proceeding with great rapidity. It is in the form of an open fan. All the corridors will arrive at a common centre, from which the whole may be inspected. The prison is to contain 1200 cells, and the total expense is estimated at 4,381,000f. It is to be called La Nouvelle Force.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

Six Months allowed for Enrolment, unless otherwise expressed.

SUPPLEMENT TO PATENTS GRANTED IN JUNE.

William Newton, of Chancery-lane, civil engineer, for "*improvements in the preparation of paper designed for bank notes, government documents, bills, cheques, deeds, and other purposes, wherein protection and safety from forgeries or counterfeits are required.*" (A communication.)—Sealed June 10.

Thomas Mitchell, of Dalton, York, dyer, for "*a machine and apparatus for increasing and permanently fastening the face or gloss of all kinds of woollen, worsted, and fancy cloths, by the application of steam alone, without immersing the goods in water.*"—June 15. Two months.

Thomas Richard Guppy, of the Great Western Iron Ship Building and Steam-engine Works, Bristol, civil engineer, for "*improvements in the building of metal ships and other vessels.*"—June 15.

George Edmund Donisthorpe, of Bradford, York, top manufacturer, for "*improvements in combing wool and other fibrous substances.*"—June 15.

John Oliver York, of Upper Coleshill-street, Westminster, engineer, and William Johnson, of Horseley Iron Works, Staffordshire, ironmaster, for "*improvements in paving or covering roads, streets, and other ways or surfaces.*"—June 15.

Samuel Mason, of Northampton, merchant, and Caleb Bedels, of Leicester, manufacturer, for "*improvements in the manufacture of boots, shoes, slippers, overalls, and clogs, and improvements in machinery or apparatus used in such manufacture, and in the preparation of materials for the said manufacture.*"—June 15.

William Edward Newton, of Chancery-lane, civil engineer, for "*improvements in apparatus for propelling vessels.*"—June 15.

George Robins Booth, of Hanley, Stafford, manufacturer and chemist, for "*an improved mode of applying heat from various combustibles to manufacturing and other useful purposes.*"—June 15.

Thomas Oldham, of Manchester, manufacturer, for "*an improved mode of manufacturing bonnets and hats.*"—June 15.

Oglethorp Wakelin Barratt, of Birmingham, experimental chemist, for "*improvements in gilding, plating, and coating various metallic surfaces.*"—June 15

Lemuel Wellman Wright, of Gosford Cottage, North Wales, engineer, for "*improvements in machinery or apparatus for bleaching various fibrous substances, and is also in possession of an invention of improvements in machinery or apparatus for converting or manufacturing the same into paper.* (A communication).—June 15.

GRANTED IN ENGLAND FROM JUNE 22, TO JULY 26, 1843.

Louis Le Page, of 72 Lombard-street, for "*an improved method or methods for preventing accidents on railways.*" (A communication.)—June 22.

William Wylam, of Newcastle-upon-Tyne, merchant, for "*improvements in the manufacture or preparation of fuel.*—June 22.

Samuel Ellis, of Salford, Leicester, engineer, for "*improvements in weighing machines, and in turn tables to be used on or in connexion with railways, and in weighing machines to be used in other places.*"—June 22.

Samuel Eccles, of Hulme, Lancaster, machinist, and Matthew Curtis, of Chorlton-upon-Medlock, machinist, for "*improvements in looms for weaving.*"—June 22.

Mose Poole, of Lincoln's-inn, gentleman, for "*improvements in collars for horses and other animals.* (A communication.)—June 23.

Nicholas Troughton, of Swansea, Glamorgan, gentleman, for "*improvements in dressing ores requiring washing.*"—June 23.

William Needham, of Birmingham, gunsmith, for "*improvements in fire-arms.*"—June 24.

John Duncan, of 72, Lombard-street, gentleman, for "*improvements in the casting and construction of types for printing.*" (A communication.)—June 26.

Charles Townsend Christian, of Saint Martin's-place, Saint Martin's-lane, East India army agent, for "*improvements in the construction of steam-engines.* (A communication.)—June 27.

Richard Waller, of Bradford, York, coach-builder, for "*improvements in locomotive carriages, and in steam boilers and engines.*"—June 27.

John Thomas Betts, of Battersea, gentleman, for "*improvements in covering and stopping the tops of boxes, jars, pots, and other vessels.*" (A communication.)—June 27.

Edward Johnson, of Nelson-square, Blackfriars-road, Surrey, surgeon, for "*improvements in apparatus for bathing.*"—June 27.

Alexander Parkes, of Birmingham, artist, for "*improvements in preparing solutions of certain vegetable and animal matters, applicable to preserving wood and other substances, and for other uses.*—June 27.

Charles Kurtz, of Liverpool, manufacturing chemist, for "*an improved lamp, for the combustion of naphtha, turpentine, and other resinous oils.*"—June 30.

Charles Tetley, of Bradford, gentleman, for "*an improvement or improvements in the construction of boilers, otherwise generators, for producing steam.*"—June 30.

James Lancaster Lucena, of Garden-court, Middle Temple, Barrister-at-law, for "*improvements in steam engines, and in machinery for propelling vessels, which improvements are applicable to other purposes, being an extension of a patent for the term of five years granted by his late Majesty King George the Fourth to Alexander Galloway, of King-street, Southwark, engineer.*"—July 1.

James John Green, of Woolwich, surgeon, for "*improvements in apparatus for securing, or fixing, standing, rigging and chains, and other tackle.*"—July 1.

Charles Phillips, of Chipping Norton, Oxford, engineer, for "*improvements in apparatus or machinery for cutting corn, grass, and such like standing or growing crops, and in apparatus or machinery for cutting vegetable substances as food for cattle.*"—July 3.

Thomas Wedlake, of Hornchurch, Essex, machinist, for "*improvements in machinery for making hay, which improvements are applicable to other agricultural purposes.*"—July 3.

James Verity, of Leicester-street, Regent-street, boot and shoemaker, for "*improvements in the heels and soles of boots and shoes.*"—July 3.

James Hartley, Wear Glass Works, Sunderland, glass manufacturer, for "*improvement in the manufacture of glass.*—July 3.

James Boydell, junr., of Oak Farm Works, Stafford, iron master, for "*improvements in the manufacture of metallic roofs and joists, and improvements in joining sheets or plates of metal, for various purposes.*"—July 6.

Florimond Delcroix, jun., of Norfolk-street, Strand, merchant, for "*improvements in furnaces for locomotive and other engines, and in the apparatus used for regulating the escape of steam, and the passage of air in chimneys of furnaces.* (A communication.)—July 6.

James Neville, of Walworth, civil engineer, for "*improvements in the form and manufacture of horse shoes.*"—July 6.

John Wright and Richard Wright, both of Richmond, York, boot and shoe makers, for "*improvements in boots and shoes, and other like covering for the feet.*"—July 6.

Joseph Cooke Grant, of Stamford, Lincoln, ironmonger, for "*improvements in the construction of harrows.*"—July 6.

John Woodhouse Day, of Well Field, Durham Colliery, and land agent, for "*improvements in apparatus to facilitate the loading of vessels with coal, culm, or cinders.*—July 6.

George John Newberry, of King William-street, London, artist, for "*improvements in the manufacture and construction of window blinds, screens, shutters, and other similar articles, parts of which improvements are applicable to other purposes.*"—July 6.

Henry Clarke Ash, of Birmingham, manufacturer, for "*improvements in the construction of teapots.*"—July 6.

James Booth, of Liverpool, clerk, and doctor of laws, for "*improvements in the means of converting rectilinear into rotary motion, and of converting rotary into rectilinear motion.*"—July 6.

Thomas Masters, of Upper Charlotte-street, St. Pancras, confectioner, for "*an improved freezing, cooling, churning, and ice-preserving apparatus, the parts of which may be used separately or in combination.*"—July 6.

James Joseph Brunet, of Limehouse, esquire, for "*improvements in propelling, parts of which improvements have been communicated to him by a foreigner residing abroad.*"—July 6.

George Parsons, of West Lambrook, Somerset, gentleman, for "*a portable roof for various agricultural, and for other purposes.*"—July 7.

George Parsons, of West Lambrook, Somerset, gentleman, and Richard Clyburn, of Uley, Gloucester, engineer, for "*improvements in machinery for beating, cleansing, and crushing various animal and vegetable materials or substances.*"—July 10.

Jacob Samuda, of Southwark Iron-works, engineer, for "*improvements in the construction of steam-engines, particularly applicable to the purposes of steam navigation.*"—July 10.

John Laird, of Birkenhead, Cheshire, ship-builder, for "*improvements in the construction of steam and other vessels.*"—July 10.

William Edward Newton, of Chancery-lane, civil engineer, for "*an improved agricultural machine, or implement for ploughing, harrowing, or tilling land.*" (A communication.)—July 13.

Richard Laming, Radley's Hotel, New Bridge street, Blackfriars, London, gentleman, for "*improvements in the purification and application of ammonia, to obtain certain chemical products.*"—July 13.

Joseph Maudslay, of Lambeth, engineer, for "*improvements in machinery used for propelling vessels by steam power.*"—July 13.

George King Sculthorpe, of Frederick's cottages, Coleharbour-lane, gentleman, for "*an improved method of fastening and securing bedsteads.*"—July 13.

Henry Pinkus, of No. 1, Duke-street, Portland-place, esquire, for "*improvements in the methods of applying motive power in combination with apparatus and machinery, to certain purposes in propelling, and applicable to railways, to ships, or other vessels afloat.*"—July 13.

Stephen Geary, of Hamilton-place, King's-cross, architect and civil engineer, for "*improvements in machinery or apparatus for clearing, cleansing, watering, or wholly or partially covering with sand, or other materials, roads, streets, or ways, and which machinery is also applicable to other similar purposes.*"—July 13.

William Midworth, of Mansfield, Nottingham, brass founder, for "*improvements in the construction of what are commonly called street guard plates for public water services, and in the mode of constructing the stop-valves, stoppers, or stop-cocks, used therein, and which stop-valves, stoppers, or stop-cocks are also applicable to various other purposes, where the flow of water, or other liquids, is required to be regulated or suspended.*"—June 13.

Henry Smith, of Birmingham, Warwick, for "*improvements in apparatus for fastening doors, and in apparatus for giving action to alarums.*"—July 13.

William Hutchison, of Ivy Bridge-lane, Strand, marble and stone merchant, for "*improvements in machinery for cutting marble and other stones.*" July 13.

James Neville, of Walworth, civil engineer, for "*improvements in obtaining power by means of gases, applicable to working machinery.*"—July 13.

Ann Wise, of Saville-row, Burlington-gardens, Parisian corset-maker, for "*improvements in the construction of stays and umbilical belts.*"—July 13.

Robert Ransome, of Ipswich, ironfounder, Charles May, of the same place, also ironfounder, Arthur Biddell, of Playford, Suffolk, farmer, and William Worby, of Ipswich, foreman to Messrs. T. R. and A. Ransome, for "*improvements in machinery and apparatus used for ploughing and scarifying land, and for raking, and for improvements in machinery and apparatus used for thrashing, cutting, and grinding for agricultural purposes, and for improvements in the construction of whipple-trees.*"—July 15.

James Overend, of Liverpool, gentleman, for "*improvements in printing fabrics with metallic matters, and finishing silks and other fabrics.*"—July 15.

William Garnett Taylor, of Halliwell, Lancaster, cotton spinner, "*for improvements in machinery for spinning cotton and other fibrous substances, and in preparing and dressing yarn for weaving.*"—July 15.

James Gallop Beater, of St. Clement's-place, Worcester, tailor, for "*improvements in the fastenings for trouser-straps, and in fastenings for wearing apparel generally.*—July 20.

Henry Austin, of Hatton-garden, civil engineer, for "*improvements in the construction of water-closets.*"—July 20.

Charles Bertram, of the Borough of Newcastle-upon-Tyne, esquire, for "*an improved mastic or cement, which may be also employed as an artificial stone, and for coating metals and other substances.*"—July 20.

Joseph Harvey, of James-street, Buckingham-gate, gentleman, for "*improvements in the construction of two-wheeled carriages.*"—July 20.

William Daniell, of Abercarne, near Newport, Monmouth, tinplate manufacturer, for "*improvements in rolling iron into plates or sheets.*"—July 22.

James Nasmyth, of Manchester, engineer, for "*improvements in machinery or apparatus for driving piles, part or parts of which improvements are applicable also to forging or stamping metals and other substances.*"—July 22.

Joseph Daniel Davidge, of Greville-street, Hatton Garden, machinist, for "*improvements in manufacturing certain materials as substitutes for whalebone applicable to various useful purposes, and in the machinery for effecting the same.*"—July 24.

David Napier, of York-road, Lambeth, engineer, for "*improvements applicable to boilers or apparatus for generating steam.*"—July 25.

Frederic Lewis Westenholz, of 151, Regent-street, merchant, for "*a double-centred steam-engine.*"—July 25.

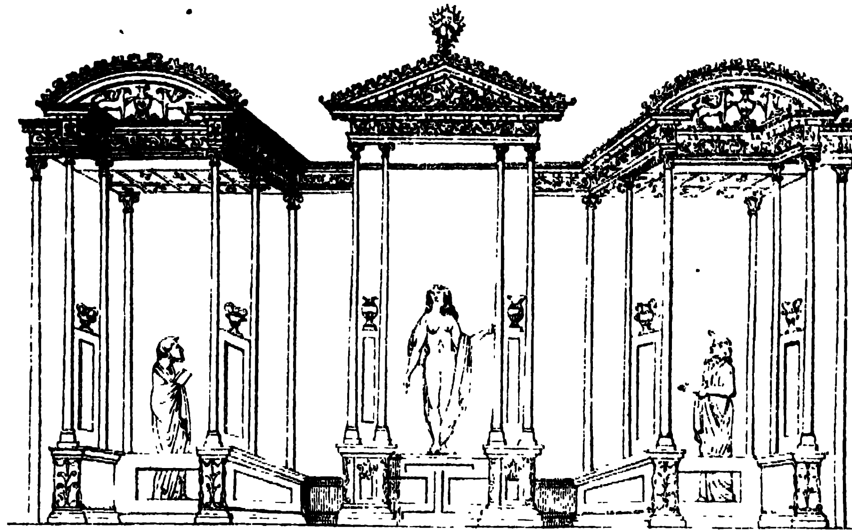
Samuel Faulkner, of Manchester, cotton-spinner, for "*improvements in the machinery or apparatus for carding cotton and other fibrous substances.*"—July 25.

Edward Eyre, of Poole's Hotel, London, gentleman, for "*improvements in railways, and in the machinery or apparatus employed thereon.*"—(A communication.)—July 26.

William Crofton Moat, of 28, Upper Berkeley-street, Marylebone, surgeon, for "*a method of obtaining aerial locomotion.*"—July 26.

ON THE EFFECTS WHICH SHOULD RESULT TO ARCHITECTURAL TASTE, WITH REGARD TO ARRANGEMENT AND DESIGN, FROM THE GENERAL INTRODUCTION OF IRON IN THE CONSTRUCTION OF BUILDINGS.

Essay to which the Medal of the Institute of British Architects was awarded in 1842.



Decorative Architecture from the Baths of Titus.

GREAT and manifold have been the disputes on the terms beauty and taste. Right reason and sound judgment seem to enter principally into the composition of the latter quality, whether applied to morals or the fine arts, and with regard to the former, much cloudy argument may be cleared away by considering beauty in two points of view—as positive or intrinsic, and relative; the former appealing to the senses, the latter addressing itself to the understanding. The agreeable sensations arising simply from the form or colour of an individual object, is due to its intrinsic beauty. Relative beauty arises from the fitness of things—from the perception of a means adapted to an end—from the parts being well calculated to answer the design of the whole. Relative beauty, therefore, being intimately connected with utility, is that which we principally recognise in architecture. Many objects intrinsically beautiful may occupy a prominent station in an architectural composition; but although strong and abiding associations of ideas, may often render it difficult to distinguish intrinsic from relative beauty, yet it is certain that beauty is produced in architecture in the most eminent degree, by combinations of parts, none of which could justly be called beautiful if separated, and considered singly on their own merits; and it is no less certain, that the most beautiful elements of architectural composition contribute nothing to the beauty of the whole, unless properly associated. They merely become absurd, as may be seen daily in the base prostitution of the exquisite models of Greek art.

That beauty in architecture is inseparably connected with the ideas of fitness and utility, is made evident by the fact, that we acknowledge the highest degree of beauty to subsist in the most opposite extremes of taste—in other words, that the exercise of judgment and reason, which constitutes taste, leads us to consider beauty with reference to fitness and utility; and if one modification of architecture is admitted to a pre-eminence over others, it is because its fitness is the most obvious, and the means by which its purpose is attained, more simple and immediate. Whether we contemplate the architecture of the Egyptians or the Greeks, the stupendous piles of the Eternal City, the gorgeous monuments of the Gothic style, the mazy intricacy of the Alhambra, or the finished productions of modern Italy, the mind perceives, in each and all, the adaptation of the means to the end, and the development of the spirit of the age and country, in which, and for which, they were created, and these form the essential principle of the relative beauty of architecture. Now where shall we turn to find the beauty born from the spirit of our age and country, in the architecture of the 19th century? The very proposition at the head of this paper is an answer. In the 19th century we are in possession of a material in extensive operation, offering us new modes of construction, new proportions, the power of creating new forms and combinations, differing from every thing that has preceded them in art. It is now 62 years, since the erection of the bridge at Colebrook-dale first revealed the capabilities of cast iron in construction on a large scale; and during that period, science and cast iron have marched hand in hand, with strides it is amazing to contemplate. But what has *art* effected with this new power? The Institute of British Architects are still at the inquiry "what effect should result to architectural taste, from its general introduction?"! In the real adaptation of cast iron to architecture as an art, we are much where the Dorians were, when they had placed four trunks of trees in a row with a tile upon each. There the Doric order might have remained, had the Dorians been of our stamp, and there it would have remained had trunks of trees instead of cast iron been first used in construction in our time. Or perhaps the parallel will run closer, if we compare ourselves with the ancients, when they first adopted the principle of the arch, since they combined it with architectural forms already established; as we shall probably seek to do with cast iron, whenever we begin to bestow our attention upon it. After 62 years' experience, under circumstances through which a new and original style of architecture might have been developed, we are still where the Romans may have been when they built their Cloaca Maxima.

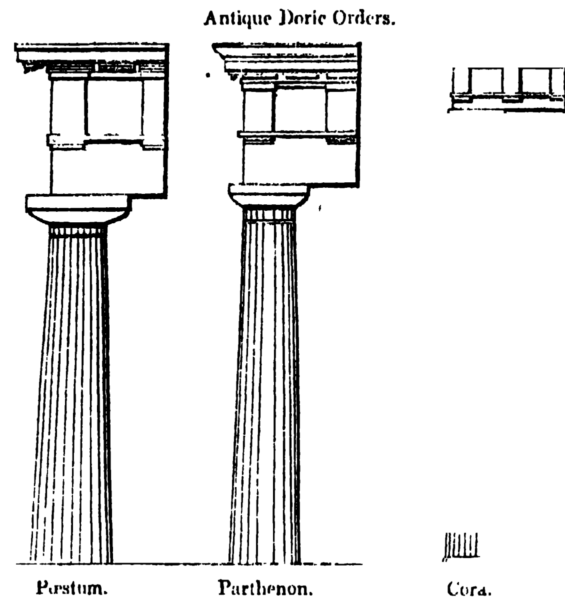
To what are we to attribute this stagnation in all our ideas, as regards art in this point of view? Doubtless, to the blind spirit of imitation and obstinate adherence to precedent (whether applicable or not, seems of little importance) which characterises the architecture of the present day. Where cast iron is to be used, the first requisite seems to be to keep it out of sight, or to make it look as much as possible like something else. To impress upon it the character of a style would be more in the spirit of the ancients, whom we profess to adore. Not that it is in the power of any man to stand forth and say, "I will invent a style." A style, like a language, must be the growth of time and circumstances; and who is to make the first essay in an age when precedent is "the be-all and the end-all," and when he who cannot command success, cares not for the higher distinction of deserving it?

The fatal effect of this spirit on our architecture might be evidenced in various ways. What has been advanced on the subject of cast iron is very far from being the strongest point in which it might be shown, but the argument must be limited to the question under immediate con-

sideration. may, perhaps, be further illustrated by a *reductio ad absurdum*. Let us suppose that the Greeks had possessed no marble, but had known the art of casting large weights of iron, and had thought proper to use it "with regard to arrangement and design," as it *might* have been used in their hands; we will further suppose that the art had been lost; we should, perhaps, still have looked upon the monuments of antiquity so designed and constructed, in the same vulgar spirit with which it has been the fashion to contemplate the Parthenon—as something to be imitated. How would our "genius have been cramped"! (as the phrase is). How should we have lamented at finding ourselves restricted to the use of stone, or marble, in which we should have sought in vain to reproduce the light forms of antiquity! Instead of striking out original proportions, and combinations adapted to our means, we should sit down perfectly convinced that neither beauty nor character could be created under the disadvantage of such materials, and abandon ourselves in despair to the construction of bare walls, the monotony of which might now and then be relieved by the crash of a public building, though the laudable attempt of some *classical* genius to support it on Bath stone columns five-and-thirty diameters high. Extravagant as this notion may appear, it is not without its parallel, in the neglect of the present generation to seek for the elements of beauty in a material which new wants and new principles of construction are every day rendering more and more inevitable in our constructive architecture. It is not, of course, with the intention of suggesting any new mode of treating cast iron in point of art, that these observations are submitted to the Institute; but we may fairly infer that neither the ancient nor mediæval architects who have bequeathed to us inventions in art, which (lacking as we do the vivifying spirit of original thought) it cost us something even to imitate with success, would have overlooked the peculiar capabilities of a material holding so important a place in their constructive architecture, as cast iron now does in ours. Material has, in all ages and styles, performed an important part in modifying design; and it is recognised as one of the most important elements of relative beauty, as exhibited in architecture, that the real and apparent construction should assimilate, and that the soundest architecture, in whatever style, is that in which art has turned to beauty and ornament the forms and proportions dictated by necessity, or by science. Without, therefore, hazarding any new or startling problems on cast iron, or on architecture in general, it may be to the purpose to enter into some inquiry as to the use of metal in the arts, its influence in modifying design, and the purposes to which it might be applied in architecture, without losing sight of the precedents afforded by antiquity and the middle ages, to which we seem bound hand and foot.

1. Let us consider first, how far the proportions of the supports, which is the most obvious effect to be produced by the formation of a genuine style adapted to the use of cast iron, is to be reconciled with any principle derived from the works of antiquity. It will scarcely be disputed, that no proportion of parts, so long as there is a perfect accordance in the different members of any composition, is inconsistent with beauty. That this was a principle of ancient art, may be inferred from the fact, that among the numerous examples of the Doric order, which have survived from antiquity, no two present the same proportions. Nor can it be argued, that on the ground of proportion exclusively, any one is more perfect than the rest, since each must be viewed with reference to the character impressed upon it, whether tending most towards majesty or grace; and its beauty will consist in the perfect accordance between one feature and another. It was a remark of Sir John Soane, that this diversity in the antique orders of architecture, was not the result either of caprice or negligence, but of a careful study of the effect intended to be produced. Thus from the temples of Pœstum to that of Cora, the Doric column passes through a variety of proportions, ranging from 4½ diameters in height to 9. To what proportions the architects of antiquity might have drawn out their supports, had metal entered into their construction as largely and familiarly as it now does into ours, it would be treading on dangerous ground to offer a conjecture; but that they conceived, and freely designed, in a style of architecture of extreme tenuity, when they were unembarrassed by solid materials, is evident, from the decorations of Herculaneum and Pompeii, and

Antique Doric Orders.

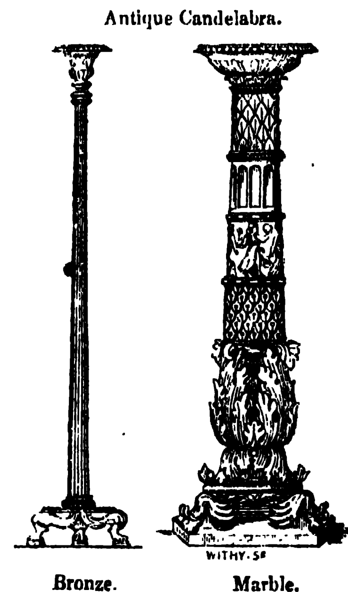


Pæstum. Parthenon. Cora.

other remains of ancient art. Nor is the architecture which the brush has perpetuated on the walls of antiquity, to be regarded as a mere *capriccio*. Throughout these decorations a great portion of the framework is architectural, and presents an assemblage of members analogous to those of regular architecture, carried out with a uniformity and consistency, which entitle these compositions to be considered as an organized style, adapted to the purpose to which we find it devoted. It is not intended by these observations, to propose that we should solidify the decorations of Herculaneum or the Baths of Titus, (though it would be easy to do worse,) but it seems indisputable, that the ancients saw nothing incompatible with beauty or good taste, in the proportions thus developed. Had it been otherwise, they would surely have avoided the semblance of architecture altogether, instead of elaborating into a regular style these exquisite creations of the fancy. (*See the head piece.*)

Although this modification of architecture is confined to painting, yet there are other works of ancient art in which proportion takes as

Antique Candelabra.

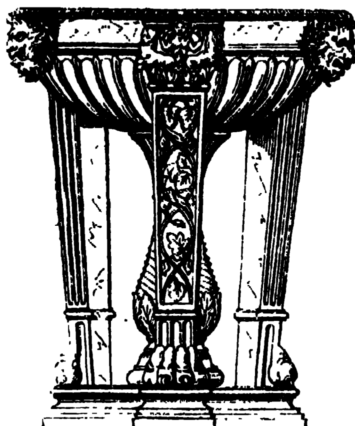


Bronze. Marble.

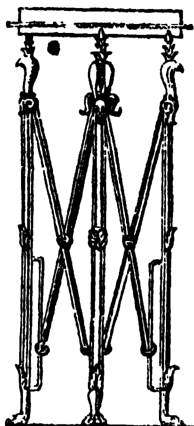
wide a range, and in which the modifications of design are to be directly traced to the nature of the materials employed, and most especially to the use of metal. The candelabra and tripods of anti-

quity, of which such numerous examples are extant, offer the most convincing proofs of the opposite extremes which beauty may touch,

Antique Tripods.



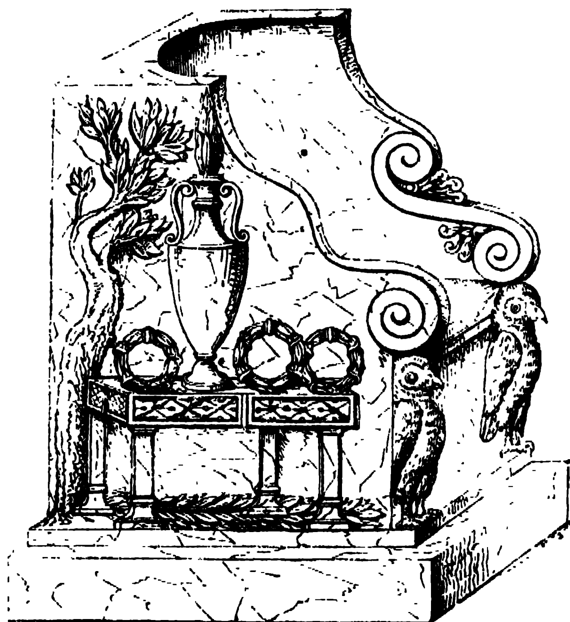
Marble.



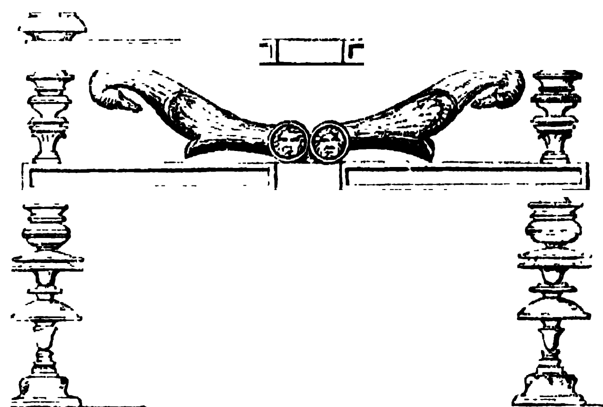
Bronze.

where it is relative and connected with the principle of reason and utility. How different are the proportions of these objects, modelled on the same general form and outline, and destined to the same offices, according to the material, marble or bronze, in which the artist has thought proper to execute them. Change the material, and the one becomes absurdly heavy, the other impracticable. And yet so little attention has been paid by the moderns to a principle which might be supposed too obvious to be missed, that it would be very easy to point out candelabra copied from antique marbles and cast in iron, without regard to the absurdity of executing the mass in metal, when designs so much more consistent with the material, and equally authorised by antiquity (since it seems indispensable to copy something) were to be had for choosing; and others might be indicated in which a better feeling, as regards the shaft, only renders more obvious the disproportions of a lumpy pedestal, substituted for the exquisite tripedal arrangement, universal in the metal candelabra of antiquity. Cast-iron, however, being so much more brittle than bronze, would require a somewhat different treatment, if considered in an original spirit. Besides candelabra and tripods, we may point to antique seats, in which the modification from the same cause is no less striking. And even in those forms, which are less open to variety from being the direct representations of natural objects, the handling is with equal skill adapted to the materials. The draperies of statues are studied with especial reference to this point; and some works of antiquity which have descended to us in marble, have been pronounced by competent authorities to be copies from bronze, on account of their peculiarity in this respect. In vases, also, there is a marked difference in the design, as the material is marble or bronze

Antique Seats.



Marble.



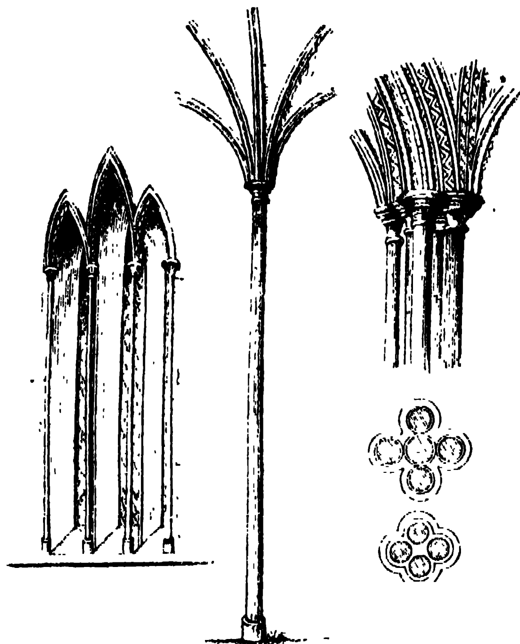
Bronze.

as may be seen in innumerable examples in the museum at Naples. If our means are deficient for carrying this parallel of the ancient practice in marble and metal much farther, it makes at least a strong case, that it is uniform and consistent as far as it goes. It is no objection to the argument which has been drawn from the decorative architecture of Herculaneum and Pompeii, that the ancients never attempted to approach that style in execution, by reducing their supports to the *minimum* which might have been permitted by the materials they were in the habit of employing. It is not contended that cast-iron is necessarily to be reduced to its minimum. The trabeated system, which is the fundamental principle of Greek architecture, and the predominant feature in the derivative style of the Romans, demanded a certain proportion between the masses which were employed for the architraves, as connected with the marble ceilings of the peristyles, the pediments, and the roof, and the columns on which they rest. We learn from Vitruvius that the ancients studied the nicest shades of distinction in these proportions. And how happily have they been determined! Human ingenuity has sought in vain to improve upon them, and every palpable deviation in parallel combinations, brings with it the sensation, that the principles of relative beauty are disturbed. Change the material, as in the timber architraves of the Tuscan order, according to the doctrine of Vitruvius, and the proportions are at once revolutionized—but without any compromise of the essential principle of beauty, since the means and the end remain consonant, and the parts are fitted to the design of the whole.

2. In considering the works of antiquity with reference to the influence of the use of metal upon architecture, we have been reduced to argue upon analogies. The consideration of another style of architecture, which divides with the *chefs d'œuvres* of Greece itself, the admiration of posterity, will afford us a much clearer view of the influence which cast-iron may exercise upon art, and what is more

without compromising the darling principle of imitation and precedent. It is indeed strange, that so little advantage should have been hitherto drawn from the employment of this material, in a style to which it so readily lends itself as the Gothic.

The principle of Gothic architecture, as opposed to the Greek, the prevalence of the perpendicular line, has been well-discriminated by Rickman; and it is not to be doubted that another principle with the Gothic architects, if indeed it be not identical with the first, was the reduction of all the points of support, both really and apparently, to a minimum. This is especially obvious in the earlier style of Gothic, where the clustered shafts alculated to effect this impression on the eye, are detached from the main body of the constructive pier with which they were at a later period incorporated. Sometimes this effect is greatly increased by a combination of isolated shafts, without the nucleus of a central pier, and in the composition of subordinate parts, as in double and triple lancet windows, where the support given by the columns is only apparent, we have single isolated shafts of excessive slenderness—and there are some remarkable



Gothic Shafts from the Lady Chapel, Salisbury.

examples, which go far to prove this principle of design to have been limited only by the capabilities of the materials employed. Such is the lady chapel of Salisbury Chapel, where four single isolated columns, 32 diameters or thereabouts in height, form, or appear to form, (it is not very certain which,) the actual support of the main vaulting of the roof, leaving after ages to marvel at the hardihood of the design, and the skill of the execution, and though last, not least, the success which has attended it. There are other cases in which it is evident that the supports have been reduced as far as prudence would admit. The nave of Herne Church in Kent, affords an example of single shafts, in which the proportions have undoubtedly been thus regulated.

Now this characteristic of Gothic architecture, which the architects of the middle ages attained generally by the help of Purbeck marble, with much limitation and difficulty, we in the 19th century have the means of producing with far greater facility, and carrying to a much greater extent, by the aid of cast-iron, which places it in our power to arrive at a degree of lightness, of which the Gothic architects could only dream, though they made bold efforts to realise it; and it does appear most extraordinary, considering how popular Gothic architecture has become, and how well its details are understood, that so few attempts should have been made to render iron available for the combined purposes of construction and beauty. On the former consideration, it has sometimes been used, but either in disguise, or with economical views only, in the naked deformity of a mere post or joist, without relation to the fitness of the whole, and with scarcely even a pretence at architectural character. Considering how essential it is in modern churches that the internal supports should cause the least possible obstruction, it is strange that the peculiar sympathy between obvious utility, Gothic architecture, and cast-iron, should not have been more diligently studied. The inveterate canker of imitation and precedent, has in this case as in others, poisoned the sources of invention. There is no original precedent for cast-iron columns, and we must therefore persist in building them with stone, or with something which is to pass for stone; or if we use iron, we must give up as impracticable all attempt to give it a genuine architectural character. We may with certainty pronounce in this case, that iron might be used strictly in the spirit of the Gothic architects; and it may even be affirmed that they would willingly have taken the utmost advantage of this material had they possessed the art of casting it. If a precedent is yet demanded, the actual use of metal, if not iron, in columns, may be seen in Exeter Cathedral, where isolated shafts of brass enter into the composition of the sedilia adjoining the altar.

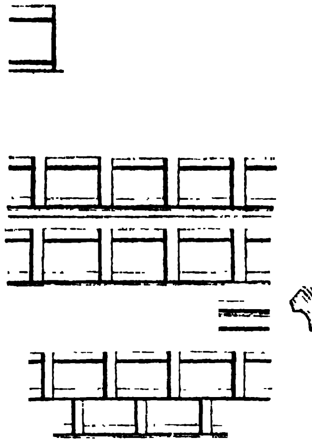
Let us bring the search after the *kalos* in the construction of Gothic columns in cast iron, to a practical test. The weight of the clerestory and roof on an ordinary church of forty feet high or thereabout, standing on lateral arches of eleven or twelve feet opening, may be about twenty tons on each column, and supposing the shafts of the columns to be twenty feet long, the requisite strength in cast-iron would be met by a diameter of six inches. Now there is no reason whatever why a column of forty diameters in height, should be abstractedly considered deficient in beauty. The effect of this, as of any other proportion, would depend entirely upon its being in unison with the other members of the architecture, or the reverse; but if we suppose a stone arch to be carried on this column, a very material practical objection arises, inasmuch as there will not be room on the top of the column to develop the necessary bulk of the stool of the arch, either as regards its construction or decoration, unless the capital were spread to a degree involving weakness, both real and apparent. Hence an incompatibility between such a column, and such an arch, destructive of relative beauty. If, however, we consider the properties of cast-iron, we shall find that a solid column on this scale is the most disadvantageous mode of employing it, since a much smaller quantity of metal expanded into a hollow cylinder will possess a much greater degree of strength. If we make the shaft of a column under these circumstances twelve or fourteen inches in diameter instead of six, we shall find, while we consult economy and utility in the column, that the arch will grow from it without exaggerating the projection of the capital, or departing in the slightest degree from any form or proportion authorized by precedent.

There is, however, an original example which might have been put in the foreground, where the columns are actually reduced beyond the proportions which the architect, for reasons best known to himself, has thought fit to give to the stool of the arch; and the capital is pieced out on each side, by a sort of attached corbel upon which the mouldings terminate. It is at Winchcombe Church in Gloucestershire. Whatever may be thought of the principle of this arrangement, the effect is very bad, but being a precedent, and therefore a desirable addition to the stock of materials for imitation, it is thought right not to withhold it. Whenever the rage for precedent and imitation shall abate, there are stupendous effects to be produced in architecture, especially of the Gothic character, by the use of iron columns; but it must be when the material is recognised to be legitimate, and not cased with deal, or "painted and sanded," or "jointed and coloured," as the price books have it, "as stone."

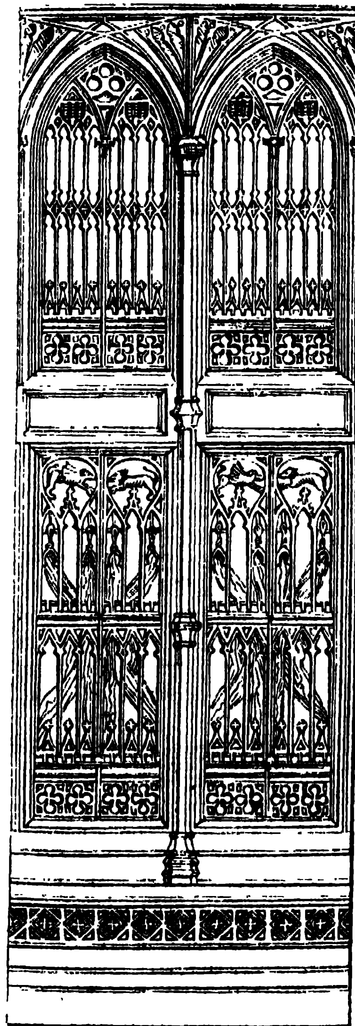
Springing of Arches, Winchcombe Church.

Thus far, in this branch of the subject, cast iron has been considered with reference to columns only. In subjecting other members of the Gothic style to a similar inquiry, it will be necessary,

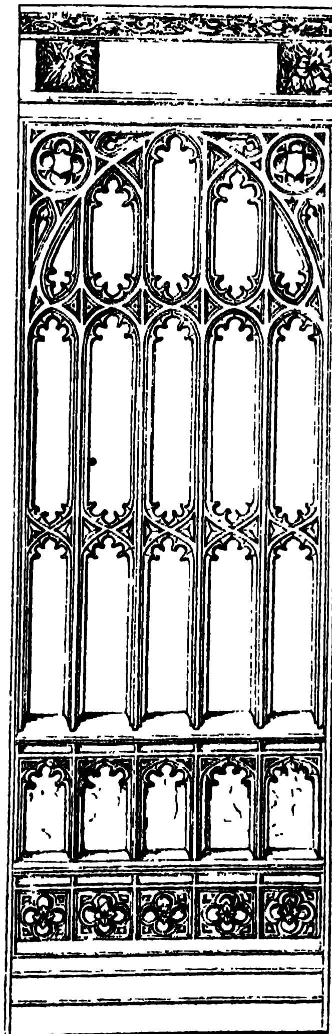
since we are arguing upon precedents, to argue with more caution, as precedents become less obvious. We may learn, from a comparison of carvings in stone and wood, how completely the mode of treatment varied with the material in Gothic as in classical art, and especially how well the relief of the ornamental parts of the work, was proportioned to the bulk necessary to the self-support of the substances employed. The skill with which a considerable variety of moulding and outline, and an effective distribution of light and shade was produced in wood without employing unnecessary thickness of material, or exposing a high relief to the destroying action of the weather, is not one of the least remarkable instances of the ability of the Gothic architects, nor the least worthy of careful examination by their imitators, some of whom have nevertheless studied to bestow upon woodwork, all the amplitude of relief to be found in precedents executed in



Gothic Mouldings in wood.



Screen of Henry VII. Tomb.



Screen of Islip's Chapel.

stone. From the practice of our masters in this respect, we may safely infer, as we have done before, that they would have displayed equal skill in devising new proportions and new modes of treatment for iron, had they applied it to as many and as important purposes in construction, as might be devised and executed at the present day.

Such purposes and modifications, it must be repeated, it is not the intention of the present essay to suggest; but the inference is not one of mere conjecture, since we actually possess works of art of the middle ages in metal, legibly stamped with the peculiar influences of the material, to which sundry modern attempts to Gothicize in cast iron are very unlike indeed.

Before we proceed to more elaborate works, it is worth while to point out the various patterns in which the iron and lead work is disposed, in the windows of the early Gothic. A series of these designs will be found in Carter's Ancient Architecture (Part 1, plate 79). It is true that these forms are subservient to the display of stained glass, but, independently of the glass, they are worthy of consideration and study. At the Sainte Chapelle at Paris, the iron work rivals the tracery of later times in the variety and richness of the patterns. The material in these examples is wrought iron, but very little modification would be necessary to execute them in cast, and since iron bars are indispensable in all Gothic windows, it is extraordinary that so little advantage should have been taken of this mode of turning them to account.

Although this simple and obvious mode of employing iron in Gothic architecture has been generally overlooked, more than one instance might be adduced in which it has been used for the entire window frames, but without any idea beyond that of imitating stone; that is to say, of adapting the material to as inappropriate a model as possible. In these performances the forms furnished by precedents in stone are so closely imitated, and the bulk of the parts, and relative breadth of the openings so far approached, that the result is a most uncomfortable sensation of meagreness, weakness, and disproportion. Had the analogy with stone been openly abandoned, and the supports made no greater than is necessary, the material would at once be recognized, and the mind so far satisfied. In what way the Gothic architects would have treated a metal window frame, we may infer from two works in metal, in which analogous architectonic combinations are developed; viz., the screen of Edward IV.'s monument at Windsor, actually executed in iron, (what can precedent do more for an uninventive age?) and that of Henry VII. at Westminster, in brass. A comparison of a portion of the latter with a compartment of the stone screen of Islip's Chapel, of about the same superficies, will explain better than many words the peculiar influence of metal, upon original Gothic composition. Whenever we recognise cast-iron as a material susceptible of beauty, there is nothing upon which its capabilities will be more successfully developed than in windows, Gothic or otherwise. Of closely barred windows and *grilles*, we make abundant use for various purposes, but we have scarcely thought of decorating them, except when some ambitious ironmonger presses the favourite "*Greek honeysuckle*" into some new invention, more foolish than the last.

The subject proposed by the Institute, upon which the foregoing observations have been offered, is one of the greatest importance in the present state of the arts and sciences in England. The modes in which it may be discussed are many; and valuable hints in architectural composition might be elicited, if it were proposed with the object of studying the capabilities of the material, and suggesting modes in which they might be made available in art as well as in science. In the preceding remarks, it has been taken in a single point only. The general argument on the effect of material upon design might be extended, without perhaps digressing more than might be allowable, and the modifications of our native architecture in the chalk and rubble churches of Kent—the decorative flint-work of Norfolk and Suffolk—and the different treatment of the detail, in the contemporaneous structures of the counties of Lincoln and Gloucester, contingent upon the quality of their stone, would afford ample and decisive examples bearing not too remotely on the main subject—but all

this is too extensive and important to be treated in a mere digression. It is a vice of the present school of architecture to neglect obvious and natural resources in construction, to produce showy falsities, and to be ashamed of sound realities. To support this proposition would lead to another dissertation, but it would be unjust to conclude without qualifying the general observations already made upon this tendency, by admitting that there are many honourable exceptions. To select examples would be invidious, but it may be allowable to mention what has appeared in print, and it would be throwing away the advantage of a powerful support to the argument which has been pursued, not to refer to the letter on ecclesiastical architecture, addressed to the Bishop of London by Mr. John Shaw.

The most considerable attempt ever made to connect cast iron with architecture, as an art, is the construction of the new spire of Rouen Cathedral. In this work, the proportions have been carefully adapted to the material; whether the object sought has been as well attained as it might be is not now the question. The endeavour is laudable; and as we flatter ourselves that in a knowledge of Gothic architecture, at least, we have the advantage over our neighbours let us try to produce something more satisfactory.

CANDIDUS'S NOTE-BOOK.

FASCICULUS LII.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. It is with naked windows as with naked figures—the latter may be either innocent enough or grossly indecorous, just as they happen to be introduced. Put a naked figure, that may be unexceptionable in itself, into a picture where other figures are clothed, and it becomes an indecency—of which, by the bye, there is an instance which had better have been omitted, among the cartoons in Westminster Hall, where *sans-culotte* gentlemen in *puris naturalibus* "cut a figure" alongside of others who are in breeches. As to windows, the rule should be, if you can't afford clothes, that is, "dressings" for them all, bestow them on none. It does not, indeed, follow, that all are to be dressed alike, or in the same degree, for some may be comparatively in undress; but between undress and a state of nudity there is some little difference. It is nothing less than a positive violation of the ordinary and most obvious proprieties of architectural decorum, to give dressings to the windows of the principal floor only, and leave all the others absolutely bare. Yet how frequently is this done! which being the case, we must suppose that it is admired as producing at least a *smartish* look—something of would-be consequence, like that of those unhappy people who affect to be above their own class in society, yet can get into no higher one, and so render themselves objects of ridicule to both. Another most tasteless practice is that of sticking in columns and pilasters between windows which have no dressings, or if any at all, such as are by no means sufficient to produce consistency of character. Yet it is of such bungling vulgar stuff that the architectural "magnificence"—so the penny-a-line critics call it—of Regent Street, and Regent's Park palaces, and of Pimlico and Paddington, is made up. This is the sort of stuff which, as Welby Pugin—who does not always cull his words for ears polite—says, "absolutely make us *spew* to look upon them"; whence it may be supposed that John Nash and his school must have caused many a dreadful fit of land-sickness.

II. Surely architects have an excellent right to claim Mercury for their patron, as being the God of Thieves. Not content with stealing ready-made orders and columns, they generally pilfer almost every thing else, till sometimes there is nothing whatever in a design they can fairly lay claim to as their own, except the tastelessness with which they botch together their stolen ware. For their not exercising their invention at all in regard to columns, the excuse is that they are invariably far too precious to be "tampered with," and even the idea the fo. of attempting—not to produce a fresh order, but to modify the standard examples of the orders, so as to produce others, is reprobated as presumptious. Yet that they should almost invariably steal ready-designed windows too, is somewhat unpardonable, more especially as they afford very great scope indeed for diversity of design and decoration, where decoration is most of all imperatively required, if there is to be any degree of it at all.

III. Together with the very best piece of design Soane ever produced, the Bank of England exhibits some of his worst. Did we not know it to be fact, never could it be imagined that the north-west angle of that edifice, and the centre of the south front, were by the same architect; the latter is as complete a failure as the other is beautiful and picturesque—a mere jumble of ill-assorted parts, and in its *ensemble* stamped by a littleness of manner amounting even to paltriness. The arched entrances are so utterly at variance in every respect with the order, that they alone would disfigure the composition, were it otherwise ever so unexceptionable. Bad enough in themselves, they look some degrees worse than they else might, owing to the very strange contrast they make with the large square-headed Bank doors—features of rather questionable propriety in themselves—introduced into the wings of that elevation. So long as this centre part remained to be done, it was to be expected that the architect would here put forth all his force, and give us a veritable *coup de maitre*. Instead of which, when he came to what ought to have been his finishing stroke, he seems to have got quite to his wit's ends, and to have been left without an idea. Fortunately this portion of the façade will look more miserable than ever now that it is brought into close proximity with the portico of the new Royal Exchange: nor is "fortunately" here either a slip of the pen or error of the press, but seriously meant, because it is fortunate that there is now a very sufficient pretext afforded for remodelling the exterior of that portion of the Bank, so that it may not look absolutely pitiful in comparison with its new neighbour. As this part is here really loftier than the rest, so also might the order be very well made upon a larger scale than that of the wings; and indeed it was generally supposed beforehand, that such was the architect's intention; instead of which he merely piled up there what shows itself no better than an excrescence, and one in pretty much the same taste as that hoisted up on the top of the Mansion House, and which has lately been removed—an example that ought to be followed by the Bank.

IV. The precedent as to alteration set by the Mansion House might, indeed, be both greatly extended in regard to that building itself, and be followed by a very great many others, to their no small improvement. Were something, for instance, done to the body of St. Martin's Church, so as to make it tolerably of a piece with the portico, that edifice might be rendered far more worthy than it now is of the reputation it holds. The National Gallery would sustain no loss by getting rid of its miserable dome; nor would Goldsmith's Hall be *improved for the worse*, were its lower part made to agree with the upper part, instead of being, as at present, two distinct halves, one with mere holes in the wall, the other with more than usually ornamented windows. Neither Somerset House nor Sir W. Chambers' reputation would suffer were the paltry "pigeon-house" turrets on the sides of the inner quadrangle to be swept away. Were, again, the United Service Club to subscribe to buy a cornice for their building, it would be a deed of charity—would be clothing the naked, and almost like feeding the hungry, for at present it has a most famished and famine-struck appearance. As to Buckingham Palace, that might very well escape intact, it being altogether incorrigible and unimproveable. Nothing short of such a judicious "accident" as those which befel the Houses of Parliament and Royal Exchange, could clear away all its vices and blunders; and it would be too much to look for a special interference of Providence to deliver the nation from such a disgrace as that precious pile of architectural gewgaw and trumpery.

V. It matters not what may be the capabilities of a style, if it be taken up by those who have no capability of their own. What is nominally one and the self-same style, will show itself altogether opposite in character according to the talent and taste, or the no talent

and no taste, brought to it, a remark which I have already made more than once before, but one which cannot be repeated too often. Of the Italian style and of the very same species of it, we meet with very striking contrasts in Barry's two club-houses in Pall Mall, and the Club-house Chambers in Regent Street. The difference as to quality and taste between the latter and the two former is hardly to be expressed, for it does not amount to much when stated in words, nor can it be indicated further than by vague, qualifying epithets. In the two Pall Mall examples we perceive a refined elegance, and a most captivating simplicity produced by what most people seem to imagine opposed to simplicity, namely the most patient study and careful elaboration of every part, even to the minutest details. There is no one part that is overdone in proportion to another; no one that is underdone. Every thing is in its proper place, and contributes to the beauty of the ensemble. There is nothing you would wish either to add or take away. Eminently beautiful in themselves, the individual features acquire redoubled charm, from the felicity with which they are combined. The Regent Street example, on the other hand, is almost the direct reverse: while it is very far from being free even from decided blemishes that might be easily pointed out, its general inferiority lies in numerous particulars and circumstances, which hardly admit of being described or pointed out, except *viva voce* with the building before one. One great defect is, that the whole looks too much squeezed together, and is consequently deficient in repose; nor is it less so in regard to richness, notwithstanding that this last seems to have been aimed at by the variety of parts—which, however, are all poor in themselves. I have heard it pretended, that the predominating characteristic of Barry's Italian style, is the cornicione: let those who fancy so, try it, and they will soon find out their mistake. There is no deficiency of cornice in the façade of the Clubhouse Chambers; but a most terrible deficiency of other merit. It is to Barry's two designs, what a very ordinary pippin is to a pine apple.

VI. One great merit of Barry, as strikingly exemplified in the two buildings above-mentioned, is that his detail is his own. Every part of it appears to have been expressly studied and devised for the actual occasion; whereas in general, even where better than usual in itself, detail seems to be taken from books or other authorities, and applied without the slightest modification, and in such manner, perhaps, as to be rather injurious upon the whole, by causing all the rest to appear in very inferior taste. Some will then, probably, ask, what is the service of purchasing expensive architectural publications, if we are not to be allowed to borrow any thing from them?—the borrowing, by the bye, meaning nothing else than stealing—which by some is practised in so barefaced a manner, that they do not even pretend to design their own details at all, but set their clerks to copy it from prints and books. The use of such examples is to study them, to form one's taste upon them, to learn to discriminate between what is excellent and what defective in them, and so to profit doubly by imbibing the true spirit of the former, and avoiding the latter. The use of such lessons, is to derive ideas from them, therefore they are not likely greatly to benefit those who stand most of all in need of such aid; it being a well known fact, that those who have fewest ideas of their own in their heads, can find least room there for those to be got from other people.

VII. It is to very little purpose for any one to attempt making a stir about the British Museum. The case is altogether a desperate one; and nothing remains for us, but to submit with graceful resignation to what must be, and to what fate—in the person of Sir Robert Smirke, irrevocably decreed long ago, shall be. It is true, circumstances have greatly altered since his Post Office was hailed by the newspapers as a most classical piece of architecture, at which time there was scarcely any other channel for architectural criticism, or the expression of opinion in regard to it, than the columns of a newspaper, which were likely enough to entertain sympathetic admiration for the columns of the great architect in question. Yet, if there has been some change in that respect, there has been none in Sir Robert; as for the matter of that, why should there be any, since he long ago attained such perfection, that [for further impro]... even, I never met with the be most unreasonable? To [t]ruth, he has given so many ex[amples] ... an individual amples of the same sort of e[...] over and over again, that half a score of them might be e[...] to some of our colonies, and we at home be nothing the poore[r].

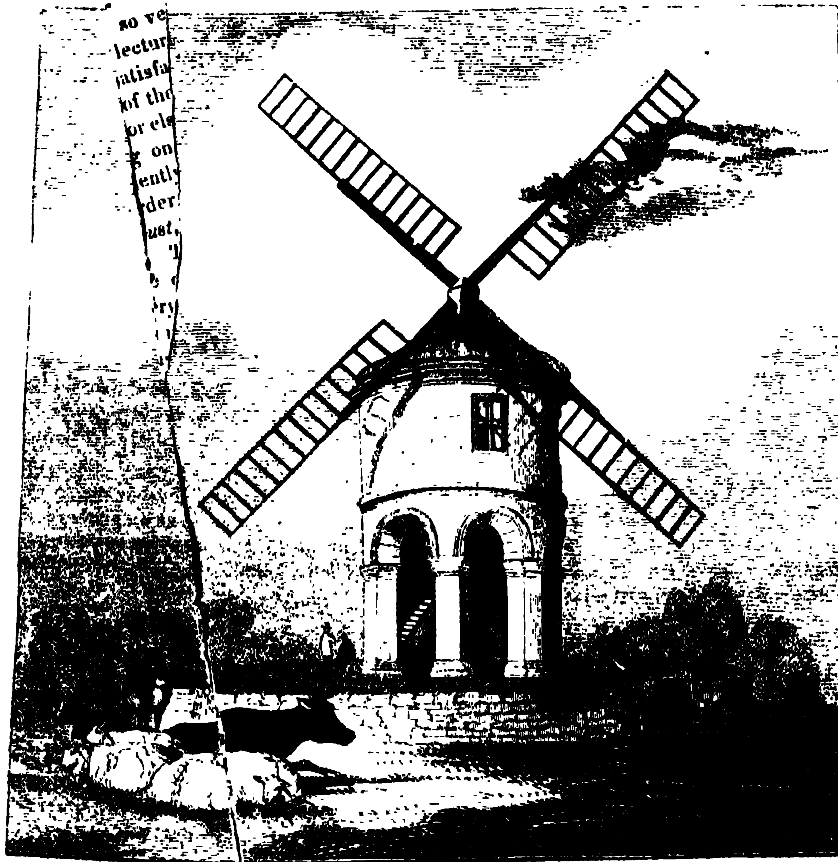
VIII. Notwithstanding tha[t ve]ry much has been said upon the orders, both in books and i[n ...]es, no one—as far at least as I am aware—has yet entered into [a satisfa]ctory comparison of ancient examples and modern application[s of the]m, showing how far their character and effect has been preserved[, or ... b]e neutralized, if not quite destroyed. So far from saying anythi[ng upon] that head, or giving any cautions at all, although they are ev[er so] enough needed, they leave it to be inferred, that provided a[... f]or a few columns be tolerably correct in themselves, all the rest [will], as a matter of course, be equally satisfactory—even admirab[le. T]hat such vast importance should have been attached two or t[hree c]enturies ago to the mere mechanical study of the orders, is n[ot] surprising, even natural and excusable. Surprising, however, it [is in n]o small degree, that such should continue to be the case much as ever. Hardly less astonishing is it, that out of the c[...]ss number of publications professing to supply general instru[ction r]elative to architecture and matters of architectural taste, ther[e is sc]arcely one which enters into the principles and rationale of co[mposit]ion—I mean into the general principles, the application of w[hich m]ust be left to individual judgment, and to the circumstances o[f each] particular case; for what may be very appropriate at one ti[me m]ay be quite the reverse at another. It is true, instruction of [this] kind must be but very limited after all, and in a manner needl[ess, bec]ause those who are most capable of profiting by it, are also cap[able of] working it out for themselves, which is after all, the very best a[nd m]ost efficient mode of study. In fact, it is this sort of study and [the c]apacity for it, which chiefly constitute talent, or in a higher d[egree,] genius. For want of continued study of this kind, even those [who] set out at first with a certain stock of talent, sooner or later, [o]ite exhaust it; which, however, may be quite immaterial in one [res]pect, because his reputation once established, a man's ability i[s t]aken upon trust. People—some people at least—may feel that t[hey] are satisfied within themselves with what has the recom[men]dation of a name; but then they feel that they ought to doubt [t]heir own judgment, or at all events do not care to seem to swim [aga]inst the stream, and accordingly with the discretion of timidity, [leav]e the world to find out the humbug in its own good time, which generally does, as witness "the great Mr. Wyatt," now transfor[med] into "James Wyatt, of execrable memory."

IX. Poor [Sir] John Soane!—now to be made after all an object of posthumous [ab]use, by the very man who was constantly toadying him in the mo[st s]ervile manner while he was alive! Yet so it is. The censure ma[y b]e merited; the suppressed work of his alluded to, may be such t[hat] no one can "conscientiously compliment the author or the man;" [bu]t supposing that character of it to be perfectly just, it is any thing [bu]t creditable—absolutely disgraceful to the other party, that ente[rta]ining such opinion of Soane, he should all the while have professe[d t]he greatest admiration and respect for him, and have eagerly sei[ze]d hold of every opportunity, and even the slightest pretext at all f[or] doing so. Instead of vindicating his "much esteemed friend's" professional character from any of the numerous aspersions that h[av]e been thrown out against it, he makes himself an opportunity [fo]r aspersing his moral character, raising suspicions all the more [pre]judicial, because, the work itself being suppressed, and not copy [no]t even in the British Museum, it cannot be ascertained how far it [re]ally deserves the reprobation so very pointedly implied. That the o[nce qu]ondam most obsequious admirer of Sir John Soane should now beco[me] his traducer, is indeed startling; but of the two, Soane show[ed] the greater discretion, for he suppressed his obnoxious work, wh[er]eas the other has been so absurdly indiscreet, as to let it now be see[n] what was his real opinion of a man whom he may be said to have wo[r]shipped in public.

this is too extensive and i...
It is a vice of ...

WINDMILL IN WARWICKSHIRE.

By Inigo Jones.



Reference to Mouldings.

A, Cornice, top of mill. B, Moulding to window head. C, Impost moulding of piers. D, Base mouldings of piers. E, String course above arches. F, Archivolt or arch moulding.

A true master mind is to be recognized not only by great works, but by its slightest and least important attempts. In particular to the artist should apply the motto, *Nihil quod tetigit non ornavit*, the same general principles of taste regulate details as regulate a grand design. We certainly must confess that some of our prominent examples of architectural proficiency recognize this rule, but on opposite grounds; with them the same frigidity and the same slovenliness prevail in a palace as in a workhouse, and the same absence of art is to be recognized in each. We do not mean this; on the contrary, we want to see the true artist exhibit himself in every performance, for negligence in details can scarcely ever accompany the grand in design; in fact, we have ever found that master minds were those of the most extended information as to minutiæ. The mind of Michael Angelo took in the whole range of art in all its variety of practical manipulations; Napoleon and Wellington, in the midst of their vastest schemes of conquest, knew how many pairs of horses' shoes each trooper had in reserve, and how they ought to be made; Homer and Shakspere have shown the greatest acuteness of observation in whatever affected their compositions. Is it to be supposed that those possessing such powers of observation, and exercising them so constantly, would consider it worthy of them to sloven over the details of their own profession? Architects and architects' employers, we are sorry to say, too often think otherwise, the *mens divinior* is some cabalistic idol only to be brought forward at jubilees, or in times of some public excitement, not to be exerted and exhibited on every occa...... ..... not the feeling of our Greek, our mediæval masters; the Athenian vase, the tomb, the weapon, at once reveal their classic origin; the smallest works of the middle ages show how deeply rooted was the love of art, the same in the least piece of church furniture as in the glorious pageant of the minster itself. Such was not the feeling of our own great masters; the works of Inigo Jones and Christopher Wren afford as many points of study in their details as in their general aspect. Above we have given a representation of a windmill [1] by the former of these eminent men, a design showing how well he could bring his resources to bear on what is generally considered such an ephemeral and trivial occasion for their exercise. This work is in Warwickshire, and it will be seen that the mill is raised on a basement of six arches, which contains the mill stairs. The cornice at the top of the mill, the impost moulding of the piers, the base moulding of the same, the string course above the arches, and the archivolts, show that he has not been negligent of due and effective ornament. It is a study which many of the present day may contemplate with advantage. Simple yet ornate, not exaggerated in character, not overstepping the modest bounds of propriety, and yet giving a picturesque contour well adapted to the situation in which the object is placed.

[1] For this engraving we are indebted to our contemporary, the *Builder*

THE BRITISH MUSEUM.

Sir—Happening to visit the British Museum yesterday, I have set down a few remarks which you will perhaps give in your *Journal*, as supplementary to the paper on the subject of that edifice in your last number.

The old building is, I find, *in statu quo* as to appearance, for the façade has not yet begun to be taken down, but internally there has been a good deal of work carried on, through which a temporary boarded up passage leads from the hall to the Townley Gallery. Here havoc has begun its work, for one of the tasteful little rotundas in that suite of rooms has been cut nearly in halves, preparatorily to its final demolition. Those rooms were, it must be owned, rather too confined, considering that the Museum is open to a sometimes thronged concourse of persons; still, it is to be regretted that they could not be spared, for they are not likely to be replaced by what will be more attractive in point of architectural character. Of the Lycian or Fellowes' marbles, I will only say they are not worth a tenth part of the fuss that has been made about them, most assuredly not worth sending out an expedition to secure more of them. Should the Lycian mania continue, we may expect counterfeit antiques, equally precious, to be manufactured on the continent and imported into this country. But look there! there is *the* very thing! a real treasure, and a specimen of art that Sir Robert Smirke ought to go down on his knees to! Excuse the harum-scarumness of my manner; I am not quite mad—merely a little flighty or so. "There," said I to myself, "if Sir Robert does not make something of that, he himself ought to be made into a mummy, and sent to keep company with the mummy gentry up stairs." However, it is of no use to go on rambling at this rate, for until I explain, you will hardly guess what I am driving at. Of course you are aware of Sir Robert's penchant for columns with Ionic capitals; he has favoured us with a vast many in his time, but with scarcely two good specimens out of the whole number, forgetting that it is possible to have too much even of a really good thing. Invention is, of course, not to be thought of; for were he to give us a fresh idea of his own for any such purpose, good as it might be in itself, it would excite a hubbub against him from all the orthodox, and the classical puritans; yet he has no occasion to invent, but merely to adopt, for his façade to the British Museum, what is in the Museum itself, consequently its legitimacy can be proved on the spot. All this, you will say, is sheer rigmarole; true, and here comes the solution of it. What I am alluding to is the bold and rich antique voluted capital, on each of whose four sides or faces is sculptured a mask in full relief—a well imagined composition, and, as it seems to me, one highly appropriate for such a building as a museum, as the display of sculpture in the capitals would serve to indicate that the edifice is partly devoted to the purpose of a public sculpture gallery. Or, shall we say that external character is of no consequence, since "good wine needs no bush."

In sober seriousness, what are we to have from Sir Robert Smirke on this important occasion? What we may expect from him we too well know; but surely he will not now be allowed to go on as he has hitherto done—at least, without strong remonstrance on the part of those who, like yourself, have the means of calling attention to the subject.

I am, &c.,

C. Whyte.

ENGINEERING IN NORTH AMERICA.

Sir—I take the liberty of requesting from some of your readers a statement of the great public works which have been executed in Great Britain or Ireland, under the direction of Mr. Hamilton H. Killaly, Chairman of the Board of Works in Canada; also a reference to any reports made by him, or papers on scientific subjects which he may have contributed.

The late Governor General, in a despatch to Lord Stanley, dated Quebec, 19th July, 1842, speaks of "Engineers of great experience and scientific acquirements, who, being strangers to the country, can have no local bias;" and Mr. Killaly "believes" that "the Governor-General must principally have alluded" to him, (p. 65, and questions 383 and 391, p. 40, Ev. Beauharnois Canal, a copy of which you have.)

The proofs of the "great experience and scientific acquirements" must therefore be sought for across the Atlantic; and though tolerably familiar with, as I supposed, the names of all the eminent British engineers, and of many of the residents even, I never met with the name of Hamilton H. Killaly among them; nor did I find an individual more fortunate among my Canadian friends—including some of the first gentlemen in the province—nor in a numerous professional acquaintance here.

This explanation will, I hope, be sufficient to justify the course I have taken; and I trust there can be no impropriety in my requesting, or in any gentleman giving, the desired information, as to Mr. H. H. Killaly's "great experience and scientific acquirements."

I am, Sir, &c.,

W. R. Casey.

P.S. I take this opportunity to request the insertion of the following note.

Note to article on "Canadian Board of Works," Journal, Feb. 1843.

The length of the locks on the Welland Canal has been increased to 150 feet, "principally by representations from the merchants and forwarders of Oswego," as officially announced. This is in accordance with my view, that the Welland Canal is quite as much a New York as a Canadian work, onus of cost, and risk of income excepted.

Speaking of the income of the Lachine Canal, a late Montreal paper says, "Downwards the falling off in the transport is most serious, the steamers and most of the barges running the Lachine rapids, to save canal tolls and towage." The Cornwall Canal, around the Long Sault, was opened for a short time, large steamers using it upwards, but descending the rapids. A serious breach has just occurred, and it must be viewed as a very uncertain work for some time. The tolls on the Rideau Canal have been increased, and, in answer to a remonstrance, it was observed that the tolls on that canal should not be so low as to direct all the trade from the St. Lawrence —a novel mode of improving the communication. Lord Stanley's Bill puts the trade, *via* the St. Lawrence, on a somewhat worse footing than hitherto, about 2*s.* per quarter of wheat. I omitted to observe in the paper to which this *Note* refers, that of £320,000 appropriated for common roads, £75,000 only are to be expended in the lower province, containing two-thirds of the population, and the commercial wealth of the country; whilst £170,000 are to be expended in or in the immediate vicinity of the district, represented by the Chairman of the Board of Works.

Time is rapidly and only too fatally confirming the views contained in my communication of February. The present policy, by connecting in the public mind the engineer with the political jobber, does vast injury to the profession; brings in its train taxation on all classes; odious restrictions on the business of forwarding; and will effectually prevent the settlement of the province, by frightening the emigrant to that part of the "far west" where no public debt exists.

W. R. C.

By a typographical error the width of the locks on the Lachine Canal was stated to be "30" instead of "20 feet," the present width. The rate of insurance (in one of the notes) should be "three-eighths of one per cent."

SCREW PILE LIGHTHOUSE, AT FOOT OF WYRE.

Sir,—It having frequently appeared, not only in the newspapers and other publications of the day, but also in the report of evidence before Committees of the House of Commons, that the Screw Pile Lighthouse at foot of Wyre, was erected by Captain Denham, R.N., F.R.S.E, &c., you will oblige me by giving insertion to the following letter, addressed to me by that gentleman, inreply to a remonstrance on my part.

Alex. Mitchell.

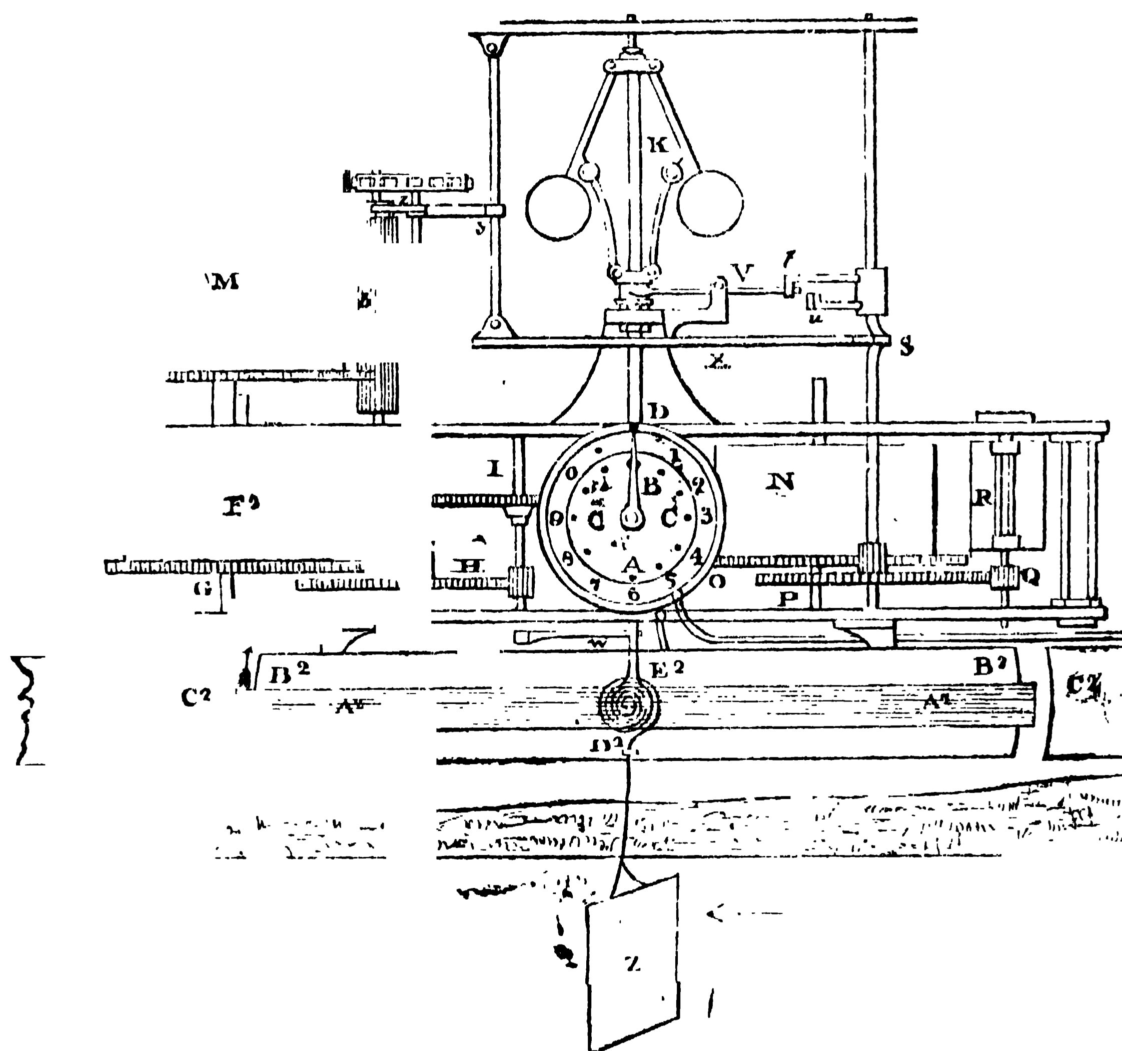
Dear Sir—At your request I have pleasure in stating, that I believe the Screw Pile is your own patented invention, and the plan of fixing lighthouses on submarine foundations (sandbanks) by their means, is also your's.

And I know that the plan, specification, and estimate of the Screw Pile Lighthouse, at the foot of Wyre, was, with the exception of the lantern, wholly prepared by yourself and son, which work you and your son erected by contract at your sole risk, after I had determined the site, and furthered the operation, by attending the tidal work in person until all the piles and pillars were planted. This statement is at your service. Remaining, your's truly,

Fleetwood, July 19, 1843. H. W. Denham.

Alex. Mitchell, Esq., Belfast.

ELECTRIC TELEGRAPHS.



The application of the instantaneous transmission of electricity, as a means of communication between distant places, promises to become one of the most important inventions of the present age, and to rival even locomotion on railways in the facilities afforded of transmitting information. The science of electricity is yet but in its infancy; and though it has, during the comparatively short period of its study, withdrawn much of the veil from the works of Nature, that which has hitherto been revealed and already accomplished by its agency, serves to show that it is capable of disclosing far greater mysteries, and of being applied to much more important uses. When the transmission of electricity instantaneously through miles of wire became known, it was not long before the possibility of applying that property to the communication of signals suggested itself to the fertile ingenuity of man. The inconvenience of using frictional electricity, and the intervals of time requisite for its excitement, however, formed difficulties which could not be sufficiently overcome. Nothing, therefore, was effected in the construction of such telegraphs, though the high state of tension of frictional electricity renders it far better calculated for traversing long lengths of wire than the electricity of feeble tension excited by chemical action. The full tension of voltaic electricity, indeed, prevents it from overcoming the resistance which even the best conductors offer to its passage, and unless the quantity developed be great, and the conducting wire be perfectly insulated, much of the power will be lost in passing through a long circuit. It was not, consequently, until after the discovery by Professor Œrsted, in 1819, that the voltaic current would deflect a magnetic needle, and the subsequent discovery that the efficacy of a feeble current on the needle may be greatly increased by multiplying the convolutions of the wire through which it passes, that the efforts to construct an electrical telegraph assumed a practicable shape.

When it was ascertained that on causing a current of voltaic electricity to pass over a magnetic needle freely suspended, the needle was instantly deflected into a position across the direction of the current, it appeared reasonable to expect that, by employing several wires and magnetic needles, and by causing the electric current to deflect either of the needles at pleasure, their deflections might be so regulated as to form intelligible symbols. In the first stage of the invention, it was proposed to have as many magnetic needles as there are letters in the alphabet, each one having a separate wire passing over it connected with one of the poles of a voltaic battery. To each needle was affixed a small screen, which, when the electric current was not passing through the wire connected with it, concealed from view a letter or a figure. A number of keys were arranged somewhat in the manner of the keys of a pianoforte, each of which was connected with one of the wires of the voltaic battery, and a letter was marked on the key corresponding with the one concealed by the screen on the needle to which it appertained. By touching any one of these keys the metallic connection was completed, and the current of electricity, on passing over the magnetic needle, deflected it, and exposed to view the letter beneath. In this manner it is evident a correspondence could be carried on between persons far apart by either spelling the words, letter by letter, or by agreeing to certain symbols for the expression of words or sentences. As the transmission of electricity occupies no perceptible time, the deflection of the needle at the distant station would take effect almost at the instant the voltaic circuit was completed by touching the corresponding key. This application of electricity as a means of telegraphic communication, appeared to realise in principle the most sanguine expectations of its efficacy, but in practice many difficulties arose. The number of wires, and the perfect insulation each one required, would have pre-

vented the plan from being practically applied, and the expense would have been a serious obstacle.

The correctness of the principle having been fully ascertained, attention was directed to render it available by arranging the needles in such manner that any two of them could act simultaneously, and thus produce a greater number of signals with a much reduced number of wires. In 1840, an electric telegraph of this kind was constructed on the Great Western Railway, for a distance of twenty miles, by Messrs. Cooke and Wheatstone. Five needles were employed on that telegraph; they were arranged on a diagonal dial, whereon the letters of the alphabet were painted, so that any two of the needles might be made to point to the letter required to be indicated. In subsequent improvements, the conducting power of the earth was rendered available for the return-current, and by other contrivances all the signals may be made with only three wires. This was a great advance on the earlier attempts at electrical communications, and if nothing further had been accomplished, the advantages of this system of telegraphing were sufficient to ensure its ultimate adoption. Within the last two years, however, the progress of invention has brought electrical communication to such perfection that, by means of one wire alone, and without an artificial voltaic battery, any signal between distant places can not only be indicated, but actually *printed* at both stations simultaneously. There are two claimants for the honour of the invention of the electro-magnetic printing telegraph, but into the merits of their respective claims we have no desire to enter. Professor Wheatstone and Mr. Bain, a watchmaker from Scotland, are the disputants, and each contends that the other has appropriated his ideas, though the mechanism of the two is not alike. The telegraph of Mr. Bain has this advantage over the telegraph of Professor Wheatstone, that it does not require the agency of any other electrical force than the natural electricity to be derived from the moisture of the earth.

It had been known for some years that a sensible degree of electricity may be developed by connecting different metallic veins, and Mr. Bain has further discovered that by placing plates of zinc and of copper underground, and connecting them by an insulated wire, a constant current of electricity is excited sufficient for working the telegraph of his construction. By this means the uncertainty, trouble, and expense of a voltaic battery is avoided, the actuating power is derived from the earth itself, and the telegraph may be worked by a single wire. We shall proceed to explain the *modus operandi* of this self-actuating telegraph, and without pronouncing an opinion respecting the comparative merits of the two competing electro-magnetic printing telegraphs, we shall be able to show that Mr. Bain's, at least, exhibits great ingenuity and vast inventive resources, and that it is capable of being extensively applied to the most important uses.

The annexed woodcut represents the apparatus in all its parts, an exact counterpart of which is to be placed at the distant station with which it is to communicate. F is a main-spring barrel acting on a train of wheels, G, H, I, which turn the balls of the governor K, and the hand B, of the dial A, B, C, whereon the requisite letters and figures are engraved. It will be observed, that the motion of the wheels is stopped by the arm E, which catches against the lever affixed to the arbor of the wheel I. To set the machinery in motion, therefore, it is necessary to remove the stop E from its bearing on the lever, and this is done by electrical agency in the following manner:—A^2 is a coil of wire twisted round a light hollow frame of wood, and freely suspended on a centre. B^2 is a powerful permanent magnet, fixed within the coil; and C^2 C^2 are sections of similar magnets. D^2 is a spiral spring connected with the source of electricity, buried underground, which leaves the coil free to move when the current of electricity passes through it, and brings it back to the original position when the electric circuit is broken. The peculiarity of this arrangement is, that the coil of wire is deflected instead of the magnet, by which deviation from the usual action, the deflecting force is rendered more energetic. The metal hand of the dial is connected with the deflecting coil, but it is insulated from the dial itself, the latter being in metallic connection with the wire laid down between the two stations, which serves to complete the electric circuit. When a metal pin is inserted into any one of the holes marked on the dial, the hand is stopped by pressing against it, and the metallic communication is then completed. The electricity thus passing through the coil of wire deflects it into the position represented in the woodcut—its natural position, towards which the spring D tends to carry it, being inclined upwards in the direction of the arrow. When the metal pin is removed, and the electric current is thus broken, the spring carries the end of the coil upwards, by which action the arm E relieves the lever, the train of wheels is set in motion, and they continue moving until the electric circuit is renewed by again inserting the metal pin into the dial. The type wheel L, on the arbor of the wheel H, is so adjusted, that when the hand of the dial is stopped at any letter, a similar letter is presented opposite to the small cylinder M, whereon the paper for receiving the printed communications is fixed. By the rotation of the wheels the balls of the governor diverge, thereby raising one end of the lever V and depressing the other, which allows the pallet *t* to escape, but the rotation of the arbor is still prevented by contact with the second pallet *u*. When the electric circuit is again completed by stopping with the metal pin the hand of the dial opposite to the required signal, the coil of wire A^2 is deflected to its former position, and the machinery is stopped by the arm E. The balls of the governor immediately collapse, and by depressing the end of the lever V, clear it from the second pallet *u*, and allow the crank spindle S (which is moved by a second mainspring in the barrel N, connected with a train of wheels) to complete its revolution. The motion of the crank presses the type against the signal-cylinder, and a piece of ribbon saturated with printer's ink being interposed between the type and the paper, the letter is distinctly printed thereon. At the same time a spring *z*, attached to an arm of the lever *y*, takes into a tooth of the small ratchet wheel *a*, on the spindle of the long pinion *b*, which takes into and drives the cylinder wheel, so that, when the crank returns to its former position, it moves the signal cylinder sufficiently to leave space for the impression of a fresh letter. A spiral motion is also given to the signal-cylinder as it turns, whereby it is gradually raised to receive the succeeding lines, and the message is, in fact, thus printed in one continuous spiral line. As the two apparatus at the distant stations are exact counterparts of each other, and are set in motion simultaneously by voltaic action, the hands on the dials always stop at the same symbol, and that symbol is printed on both at the same instant.

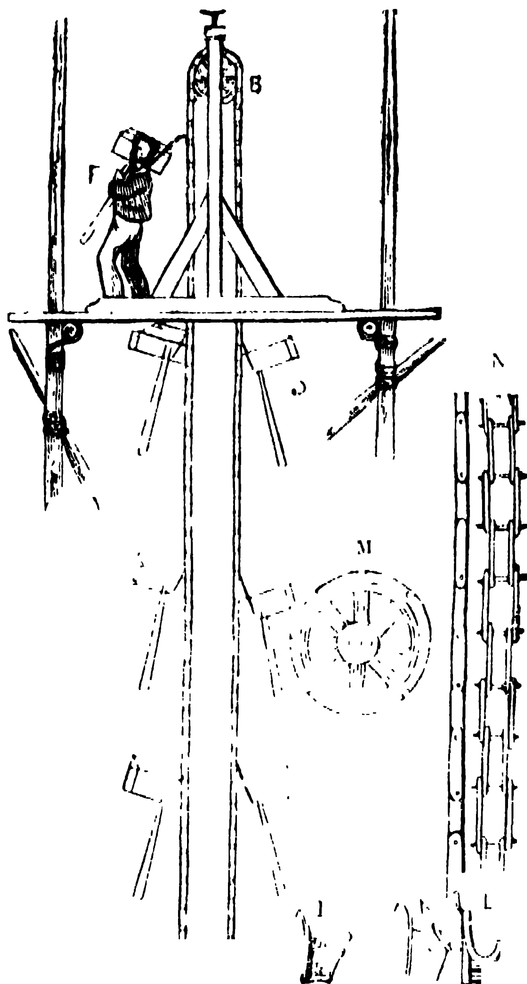
The cost of an electro-magnetic printing telegraph of the kind we have described, would not we believe exceed 40*l*. per mile. It is no doubt susceptible of further simplification; but, taking the apparatus in its present state of improvement, it is capable of extensive application, not only in transmitting information from the outports and the principal centres of manufactures, to the seat of government, but also for conveying intelligence from mercantile firms to their distant agents and correspondents. When the facility with which instantaneous communications can be made by electro-magnetic printing telegraphs becomes better known, and the plan more extensively adopted, we doubt not that public telegraphs will be established, and be considered as important as we are now accustomed to consider the establishment of a regular postage communication between all parts of the kingdom. Means might be adopted, if necessary, to secure the secrecy of communications thus transmitted, or the parties communicating might agree upon cyphers, the signification of which would be unintelligible to none but themselves.

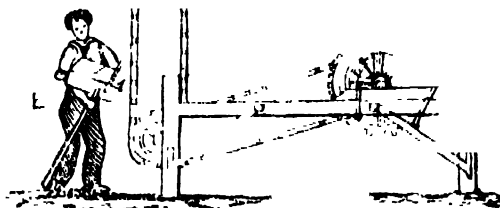
Electric telegraphs have already been applied on several railroads with signal advantage, and it only requires the simplification and cheapening of their construction, which seems to be now attained, to render their adoption on railways general. By communicating from station to station the time at which a train starts, its arrival may be anticipated with great exactness, and preparations made accordingly. This is essentially necessary in the case of special trains, and when the roads are undergoing repair, and, by thus forewarning the approach, might be the means of altogether preventing accidents from collisions.

Electric telegraphs also present an important economical advantage in the construction of railroads on lines of inferior traffic, since, by their aid, the transit of the trains to and fro might be conducted on a single line of rails with equal safety as on the most costly double line. As the departure of each train would be instantly signalled from one station to another, there would be no danger whatever, of two trains meeting; and the times of departure from each terminus could be so arranged that the up and the down train should meet at a stated point where a short double line might permit them to pass. We conceive it to be within the range of probable improvements in the electro-magnetic telegraph, that the wheel of the engine, as it passes along the rail, should be made to trace its course on the signal-cylinder of the printing telegraph, so that the position of any trains or number of trains on an extended railway might be known at a glance, and each one be seen tracing its own course on the telegraph chart of every station. But without waiting for further improvements, the electro-magnetic printing telegraph, in the state of perfection to which it has been brought by Mr. Bain and by Professor Wheatstone, affords facilities sufficient to render its adoption on all railways a point of duty with the directors, as such a forewarner of danger, it is admitted, would prove a most valuable preventive of accidents.

DOCTOR SPURGIN'S PATENT HOISTING MACHINE,

For Raising Bricks, Mortar, and any other materials employed in Building, and adapted to the Unloading of Ships and Warehousing of Goods.





In our last month's *Journal* we stated that a new machine for hoisting bricks, &c., was to be seen at Prince Albert's Gate, Knightsbridge, we are now enabled to give our readers a rough sketch of the machine, together with a description which will explain its operation.

Description of the Machine.—The main part of the machine, A, consisting of the gearing to set the machine in motion, rests upon the ground. The second part is a trestle, which may be placed upon the scaffolding of the bricklayers, as at F; in the upper part of this trestle is an indented wheel, B, which corresponds perpendicularly with a similar wheel, attached to the principal body of the machine, resting on the ground. Passing round these two wheels is an endless iron chain, which is put in motion by one or several men, who turn the handle of the machine, A, consisting of a pinion-wheel working into a large toothed wheel, on the axis of which is an indented wheel, round which an endless chain passes, and also round a corresponding wheel at the side of the one at the foot of the vertical chain; the latter is set in motion when the wheel A revolves, together with the endless chain just described, over the indented wheels at C and E, by which the chain operates its rotation. On the side of the chain ascending, the workmen attach their hods full of materials, by means of a hook fixed in the hod, as at B, and others detach them, as at F, to carry them to the bricklayers on the scaffolding. The empty hods are attached to the chain on the opposite side, as at G, and descend to the ground, where they are detached, as at H.

The chain may be lengthened and shortened as necessary. When a story is added to the scaffolding, the trestle is placed upon the new story, and the chain lengthened as required. At the top is a screw for tightening or relaxing the chain, as occasion may require.

The figures I, K, L, are accessories used for hoisting the materials, viz. I, for broken bricks; K, for water; and L, for pieces of stone for windows, chimneys, &c. M is an enlarged view of the indented wheel, and N the chain.

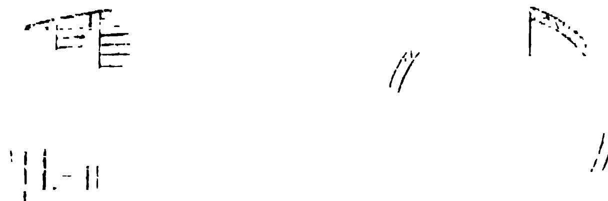
The advantages of this machine are, that it relieves the workman from the most toilsome part of his labour, by doing away with the practice of ascending the ladder; and it prevents, as far as possible, the accidents arising from this practice, to which he so often falls a victim. It also enables building operations to be carried on with much greater expedition than heretofore; and at the same time it diminishes the cost of such works.

Dynamical Table *of the Strength of a Man, showing the number of Bricks that can be carried up a Ladder by an ordinary Labourer.*

To 10 feet ..	90 bricks	per minute,	5400	per hour,	54,000	in 10 hours.
20	45	"	2700	"	27,000	"
30	30	"	1800	"	18,000	"
40	22	"	1350	"	13,500	"
50	18	"	1080	"	10,800	"
60	15	"	900	"	9,000	"

Messrs. Grissell & Peto, and Mr. Cubitt, have adopted the machine, and have it in use at this time, the former at the New Houses of Parliament, the latter at Prince Albert's Gate, Hyde Park, where the machine may be seen in operation.

ELMES' PATENT MOORING AND SIGNAL BUOYS.



Plan of the top. Section through the

Mr. Elmes, who is the Surveyor of the Port of London, observing the very great inconvenience and loss occasioned by the constant sinking of the mooring buoys on the river Thames, through perforations being made in them either by accident, or by the shrinkage of the materials, which cause them to be filled with water, turned his attention to see whether their construction could not be so formed as to render it next to impossible to sink them; the result has been the formation of the Patent Buoy, which we shall proceed to describe. In external appearance and materials, it is the same as those in general use, but through the centre there is a tube for the bridle-chain; and instead of it being attached to the underside of the buoy, it is in the patent buoy attached to the mooring ring at the top. The patentee states that the buoyancy is such that any number of holes perforated in its external surface will not injure it; and the interior of the buoy is divided into "vascular cells," which form water-tight compartments.

This invention is also applicable to all manner of floating bodies, as well as for ship's moorings, such as signal buoys, to indicate the situations of shoals, rocks, wrecks, and other dangerous impediments to navigation, for the carrying of floating beacons, flags, lights, bells, and other signals of contiguity to such danger. One of these buoys, a large beacon or signal buoy, has been floating securely for twelve months past, including the last tempestuous winter, in the bay of Dublin; and a mooring buoy of the largest size has been used, by

permission of the Port of London Improvement Committee, in the corporation moorings, on the upper outside moorings off the East India Dock entrance at Blackwall, since the 18th of October, 1841, carrying in that deep and rapid reach of the river nearly two tons of mooring chains, and sustaining at its ring some of the largest ships that enter those docks during the whole of that severe winter till the autumn of last year. In spite of this severe work, and the fact that it has not had or required a sixpence outlay in repairs, it is as buoyant as ever.

NEW INVENTIONS AND IMPROVEMENTS.

REFLECTING LANTERN HELIOTROPE.

Description of a Reflecting Lantern and a Heliotrope, used by Major J. D. Graham, *as meridian marks for great distances, in 1841, while tracing, in his capacity of U. S. Commissioner, the due north line from the monument at the source of the river St. Croix.—(From the Proceedings of the American Philosophical Society.)*

The lantern was constructed by Messrs. Henry N. Hooper & Co., of Boston, under Major G.'s directions. It was similar in form to the Parabolic Reflector Lantern, sometimes used in lighthouses, but much smaller, so as to be portable.

The burner was of the argand character, with a cylindrical wick, whose transverse section was half an inch in diameter, supplied with oil in the ordinary manner. This was placed in the focus of a parabolic reflector, or paraboloid, of sheet copper, lined inside with silver about one-twentieth of an inch in thickness, polished very smooth, and bright. The dimensions were as follows.—

	Inches.
Diameter of the base of frustrum of reflector	16·
Distance of vertex from base	3·75
Distance of focus from vertex	2·25
Diameter of cylindrical burner	·50
Diameter of a larger burner, which was never used, but which, by an adapting piece, could be easily substituted	1·25

The instrument answered the purpose for which it was intended, admirably well, and was of great use in tracing the due north line. While it occupied the station at Park's Hill, 15 feet above the surface of the ground, or 828 feet above the sea, in the latter part of September, and early part of October, 1841, the light from it was distinctly seen with the naked eye at night, when the weather was clear, from Blue Hill, whose summit, where crossed by the meridian line, is 1071 feet above the sea; the intervening country averaging about 500 feet above the sea, and the stations being 36 miles apart.

The light appeared to the naked eye, at that distance, as bright, and of about the same magnitude, as the planet Venus. Viewed through the transit telescope, of 43 inches focal length, it presented a luminous disc, of about thirty seconds of arc in diameter. From its brilliancy at that distance, Major G. has no doubt that it would have been visible to the naked eye at 50 miles, and through the telescope at 100 miles, could stations, free from interposing objects, have been found so far apart.

It was remarked, that the wick employed by Major G. was considerably smaller than that usually made, even for parlour lamps; and to this cause he attributed, in a great measure, the perfection with which the parallel rays were transmitted from the reflecting parabolic surface, so as to make them visible at so great a distance. Though a greater quantity of light is generated by a larger wick, the portion of rays reflected in a direction parallel to the axis, and which alone come to the eye, is the smaller as the flame transcends the focal limit. The size of wick most advantageous for use, may easily be determined by experiment: Major G.'s impression is, that the smaller its transverse section, provided it is only large enough to escape being choked up by the charred particles, even one-third, or perhaps one-fourth, of an inch, the farther the light would be visible.

It has occurred to Major G. that lanterns of this description might be used with great advantage as station marks, in extensive trigonometrical surveys, requiring primary triangles of great length of sides. A revolving motion might be given to the lanterns, so as to make the light transmitted from them visible from many different stations within short intervals of time. Their simplicity, and the ease with which they are managed, would perhaps give them, for such purposes, a great advantage over the Drummond or Bude lights, even though they be not so brilliant as the latter.

The heliotrope, which he employed in the day time, was made by order of Mr. Hassler, at the instrument shop of the coast survey office. It was a rectangular parallellogram of good German plate glass, $1\frac{1}{4}$ by $1\frac{1}{4}$ inch in size, giving an area of reflecting surface of $2\frac{16}{100}$ square in. This also was seen at the distance of 36 miles.

SELF-ACTING CIRCULAR DIVIDING ENGINE.

At one of the recent meetings of the Astronomical Society, a paper by W. Simms, Esq., was read describing a *Self-acting Circular Dividing Engine.* The engine, in general arrangement and construction, is similar to that made by Mr. E. Troughton, though there are several additions and peculiarities, which are pointed out. The circle or engine-plate is of gun-metal, 46 inches in diameter, and was cast in one entire piece, teeth being ratched upon its edge. The centre of the engine-plate is so arranged that it can be entered by the axis of the instrument to be divided, and the work by this means brought down to bear upon the surface of the engine-plate, which arrangement prevents the necessity of separating the part intended to receive the divisions from its axis, &c., a process both troublesome and dangerous. Upon the surface, and not far from the edge of the engine plate, are two sets of divisions to spaces of five minutes, one set being in silver and the other strongly cut upon the gun-metal face. There are also as many teeth upon the edge as there are divisions upon the face of the engine-plate, namely, 1320, and consequently one revolution of the endless screw moves through a space of five minutes. The silver ring was divided according to Troughton's method, with some slight variations. In this operation it seemed to the authors the safer course to divide the circle completely, and then to use a single cutter for ratching the edge; and he believes that the teeth upon the edge have been cut as truly as the original divisions themselves. Another important arrangement is, that the engine is self-acting and requires no personal exertion or superintendence, nothing being necessary but the winding up of the machine, or rather the raising of a weight which, by its descent, communicates motion to the dividing engine. The machinery is so arranged that it can be used or dispensed with at pleasure, there being some cases in which a superintending hand is desirable. The author then proceeds with a description of the machinery, as represented in the drawings accompanying his paper, and draws attention to the contrivance by which the engine can discharge itself from action when it has completed its work. He concluded by observing that the machinery is simple, by no means expensive, can be made by an ordinary workman, is adapted to all the engines now in existence, which are moved by an endless screw, lessens the labour of the artist and increases the accuracy of the graduated instrument.

COATING METAL.

William Henry Fox Talbot, of Laycock Abbey, Esq., has obtained a patent for "*improvements in coating or covering metals with other metals.*" Patent dated November 25, 1842. The specification of Mr. Talbot's present patent discloses no new principle in the art of metallic precipitation; but it supplies some very useful improvements in its manipulative details.—1. To prepare metal articles for gilding, Mr. Talbot dips them in a weak solution of silver in hypo-sulphate of soda. 2. To prepare an article for either gilding or silvering, he first cleans it well, then connects it to one of the wires of a voltaic battery, next plunges both poles into a vessel filled with some acid solution, which, decomposing the water, the hydrogen is given off by the article intended to be gilt or silvered. After a little time the article is detached from the battery, and thrown into a solution of gold or silver, where it speedily acquires the required coating. 3. To gild metallic articles, he makes use of a mixed solution of gold, and any one of the baser metals, with the exception of mercury, which would separate the gold. 4. He also uses for gilding a solution of chloride of gold, mixed with a solution of boracic acid, the latter having the effect of greatly improving the colour. 5. To remove the dark tint which metallic articles sometimes acquire when dipped in a solution of gold, they are immersed in a very weak solution of nitrate of mercury. Any mercury which may adhere is afterwards removed by an acid, assisted by voltaic action. And, 6. When in silvering an article, the solution of silver ceases to impart any addition to the coating (in consequence of the coating and the solution becoming of identical properties), Mr. Talbot dips it into a different solution of silver, or into a solution of some other metal, after which he replaces it in the first solution, when it is found to act with the same energy as at first. The same method of alternate dipping is also applicable to solutions of gold.—*Mechanic's Magazine.*

OXIDES OF METAL.

John Mullins, of Battersea, Surrey, surgeon, has obtained a patent for "*certain improvements in making oxides of metals, in separating silver and other metals from their compounds with other metals, and in making white lead, sugar of lead, and other salts of lead, and salts of other metals.*"—Patent dated October 27, 1842.—Mr. Mullins's improvements are six in number. First, he produces oxides of lead and other metals by forcing currents of atmospheric air, or oxygen gas, through masses of the metal in a melted state, "heated to the temperature of their respective points of oxidation," and then skimming off the oxides from the surface. Second, to make white lead he exposes the oxide of lead obtained by the preceding process, which is stated to be much superior to the ordinary litharge and vitrified

massicot of commerce, to the vapours of vinegar and carbonic acid gas. Or, third, he exposes a solution of acetate of lead, or other suitable salt of lead, made from "the oxide obtained as aforesaid," to an atmosphere of carbonic acid gas. We quote at length the patentee's description of the mode in which this is effected; it is new, ingenious, and likely to answer well. "In chambers, or large jars of earthenware, or other material, are suspended several large sponges, which are supported in the jars by strings of worsted, so as not to touch the sides of the jar, or one another. Having made a saturated, filtered, and neutral solution of acetate of lead, or of other suitable salt of lead, from the oxide obtained as aforesaid, and placed this solution in a vessel above the top of the jars, and having moistened slightly the sponges with the solution, and also the worsted strings suspending them, the strings are then made to dip into the solution contained in the vessel above the jars, and, by the power of capillary attraction, the sponges are kept constantly moist by a supply of the solution descending down the worsted strings; and the supply can be regulated at pleasure by the size of the strings, or otherwise. Evaporation is continually going on, and crops of salts of lead are formed on the surface of the sponges. The jars are made to communicate with a gas-holder, or other reservoir, containing carbonic acid gas, which gas is made to fill the jars in order that the sponges may be surrounded with an atmosphere of carbonic acid gas. By the action of the gas, the salt of lead on the sponges is readily converted into ceruse, assisted probably by the decomposition of the acid of the original solution. When it has been ascertained that a sufficient quantity of the ceruse has been formed, the sponges are removed and washed in a vessel of pure water and if the sponges contain any undecomposed soluble salt of lead, which is generally the case, the water dissolves it, but the ceruse falls to the bottom on the water remaining at rest. The water is to be re-used for forming the solution when decanted from the precipitated ceruse. The sponges are then replaced as before and the process continues." Fourth, he employs common soot to deoxidize his oxide of lead, and generally for the reduction of all metals from their ores or oxide. Fifth, when a mass of melted lead, treated by the process just described, contains any silver, the silver, being less oxidizable than the lead, accumulates at the bottom of the pot, whence it is drawn off occasionally to be farther purified and separated. And sixth, to separate iron, the oxides are discharged down a shoot, fixed at an angle of about thirty degrees, formed of wood, or of some other non conducting material, from the bottom of which the poles of a number of magnets project upwards, and to which a slow, lateral, sieve-like motion is given by machinery; the magnets attract and retain the iron, and the oxides pass free.—*Ibid.*

IMPROVEMENTS IN IRON.

JAMES PALMER BUDD, of the Ystalyfera Iron Works, Swansea, for "*improvements in the manufacture of iron.*" Patent dated October 20, 1842, Mr Budd's improved process of manufacturing iron, as contradistinguished from Neilson's and Crane's processes, may be called the *cold anthracite blast*. The points of novelty to which he lays claim are these First, the application of anthracite or stone coal combined with a blast of atmospheric air, in the natural or unheated state, maintained at a pressure or *pillar* of upwards of $2\frac{1}{4}$ lbs. on the square inch, in the smelting or manufacturing of iron from ironstone, mine, or ore. Secondly the application of anthracite or stone coal, combined with the use of water tuyeres, and with a blast of atmospheric air in the natural or unheated state, in the smelting or manufacturing of iron from ironstone mine, or ore. Thirdly, the application of anthracite or stone coal, in combination with four or more tuyeres, and a blast of atmospheric air in the natural or unheated state.—*Ibid.*

GAS.

JAMES CRUTCHETT, of William Street, Regent's Park, engineer, has obtained a patent for "*certain improvements in manufacturing gas and in apparatus for consuming gas.*"—Patent dated July 12, 1842 The "improvements in manufacturing gas" consist in producing, by a peculiar apparatus, described by the patentee, a triple compound, composed, first, of coal or other gas; secondly, atmospheric air, in the proportion of from 5 to 15 per cent); and, thirdly, vapour of naphtha, or other volatile hydro-carbon, (in what proportions is not stated). The most remarkable feature in the apparatus employed for this purpose is, that the moving power which actuates it is the gas itself. The improvements in "apparatus for consuming gas" consist in substituting for the ordinary concentric ring a spiral coil, "by which the light is equally concentrated, with the advantage that only one inlet-pipe is required."—*Mechanic's Mag.*

METAL SHIPS.

WILLIAM FAIRBAIRN, of Manchester, engineer, has obtained a patent for "*certain improvements in the construction of metal ships, boats, and other vessels, and the* [illegible]*aration of metal plates to be used therein.*"—Patent dated July 6, 1842.—The plates are so rolled or constructed as to be perfectly smooth on that side which is to become the outer side of the vessel, but along the two inside edges of the plate there are raised two bands or strips, varying in breadth, according to the thickness of the plate, and, of course, the strength of rivet to be used in joining them. The plates are to be punched in the usual way, and afterwards counter-sunk on the outside. In joining, the plates are brought edge to edge, being flush on the outside; and upon the inside is laid a piece of flat bar iron, pierced with two lines of rivet holes, so as to correspond with the holes in the plate, to which it is to be riveted. Where it is required to have greater strength, so as to resist increased external pressure, the flat bar has a raised feather along its outer side, the section of which will form that of a T. The bands, or strips, along the edges of the plate are to be of such thickness as to make the plate of uniform strength throughout when pierced for the rivets; and thus to obviate the risk of the plates being broken in that part, which is generally, if not always, found to be the result in cases of concussion, &c. The rivets are so made as to fill the countersink, and thus present a uniform smooth surface on the outside of the vessel when completed, which of course must meet much less resistance in passing through the water.—The claim is to the manufacturing of plates, and joining them as above-mentioned, in the construction of boats and other vessels.—*Mechanic's Mag.*

A FIRE-PROOF POWDER MAGAZINE.

An experiment was lately made at Paine's wharf, Westminster, for the purpose of testing the capabilities of a magazine to contain powder in ships of war, recently patented by Mr. J. A. Holdsworth, as being impervious to fire, though subjected on all sides to the greatest possible degree of heat. A model of a magazine, about nine feet square, was placed on the wharf within a few feet of the water's edge. This model is formed of a double set of thin iron plates, riveted together at about two inches and a half asunder, the hollow being filled with water, and supplied from a vat placed somewhat above the level of the magazine, and entering it through a pipe inserted in the lower part of the model. A channel of communication exists through every side as well as the top and bottom, and from the upper surface a second pipe conveys the stream of water back to the vat from which it is supplied. The door of the magazine is hung on hinges, made hollow, and guarded from leaking by stuffing boxes, so that the water flows into the door through one hinge and out through the other. The patentee having explained the principle of his invention, placed a quantity of combustible matter within the model, over which some gunpowder was laid on a sheet of paper. A registering thermometer having been placed inside, the door was closed, and a stack of dried timber deposited on every side of the model, was set a-light. The fire was kept up more than half an-hour, and the water rose to very nearly boiling heat, continually passing in a stream through the upper pipe into the reservoir containing cold water. On the door being opened, the combustible matters and powder were found to be perfectly uninjured, and the highest point to which the mercury had risen within the model was marked at 104 degrees of Fahrenheit. A somewhat similar principle has been applied to the stoker's room in the *Victoria and Albert* royal steam yacht, where the bulkheads have been constructed of two plates of sheet iron, instead of wood faced with iron, a stream of water constantly flowing between, by which means the temperature of the engine room is kept cool.

ORNAMENTAL GLASS.

MR. JOHN CARR, of North Shields, earthenware manufacturer, and AARON RYLES, of the same place, agent, have obtained a patent for "*an improved mode of operation in certain processes for ornamenting glass.*"—Patent dated 9th November, 1841, which consists of improvements in the operations of staining, stopping out, and obscuring glass. In the improved method of staining glass, the staining materials, instead of being mixed with oil of turpentine, or other volatile oils, or water, as usual, are mixed with boiled linseed oil, or such other oil as is generally employed when printing with enamel colours on glass; and instead of floating the staining materials over the glass, in a liquid state, they are printed or transferred from metal plates, and, when dry, are fixed by firing, in the usual way. When operating with staining materials mixed with oil, as aforesaid, on pot metal, or on flashed glass, opaque and transparent shades are produced, leaving the surface of the glass quite smooth, instead of being raised in those parts, as in the common mode of applying body colour, for the purpose of shading. As regards the operation of stopping out, the materials, used for that purpose, are mixed with boiled oil, and printed on the glass, in the manner above described: the liquid staining composition is then floated over the whole surface, including the parts so stopped out, and the colour is fixed by firing. After the glass has been cleaned, the pattern, which was printed on it in stopping out materials, is exhibited in the original colour of the glass, and quite distinct from the stained ground; or a printed impression being transferred to the glass, in stopping out materials, as aforesaid, the remainder of the ground may be obscured in the usual manner; thus producing transparent patterns

on obscured grounds. The improvement in the process of obscuring glass, consists in mixing the materials, which are used to produce this effect, with boiled oil, and transferring impressions from engraved metal plates on to the glass; thus producing obscured patterns on transparent grounds.—*London Journal.*

PREPARING PAINTED SURFACES OF PAPER.

Henry Martin, of Norton-terrace, Camden-town, painter, has obtained a patent for "*improvements in preparing surfaces of paper.*"—Patent dated March 30, 1840. This invention consists in embossing and enamelling the surfaces of paper, and in manufacturing paper-hangings. A coat of oil-paint, of the desired colour, is first applied to the surface of the paper, as evenly as possible, with a common paint-brush; it is then rubbed lightly over with a brush, similar to a clothes or shoe-brush (giving it a circular motion), to remove the marks of the paint-brush; after which, an additional smoothness is given to the painted surface, by passing a dry brush, called a "softener," lightly over it. If more than one coat of paint be laid on, this process is repeated. Or, instead of the above method, the paint may be applied by conducting the paper between two rollers, together with an endless felt or other fabric, which is supplied with paint by passing under a roller partly immersed in it, the superfluous paint being removed from the felt, as it ascends, by a scraper. The paper, thus prepared, is embossed, by passing it between engraved rollers or dies; or is converted into paper-hangings, by printing the required designs upon it with blocks or other surfaces. If a glazed or enamelled surface is to be given to the paper, the oil-paint must be used in a thick or round state, and thinned only with turpentine, in the same manner as if it were used for "flatting." When the turpentine evaporates, the colour becomes set; the paper is then placed upon a bed of woollen cloth or other soft material, and a pallet knife or trowel, with a polished surface, is passed over the painted surface of the paper, with a slight pressure; the colour being set, yields to the pressure, and a glaze is thereby produced, which may be afterwards heightened in the usual manner. Other means may be resorted to for glazing the painted surface of the paper, if preferred.—*London Journal.*

NEW SAFETY VALVE FOR ENGINE BOILERS.

(From the Transactions of the Liverpool Polytechnic Society.)

The Secretary read an interesting letter on this subject from Mr. Maitland, formerly a member of the society. It was dated Montreal, where the writer was then residing. The following are extracts —

"Shortly after my arrival in this country, a serious explosion took place of a steam-boiler on a canal high-pressure boat. The boiler was constructed on the locomotive principle. The effect of the explosion took place immediately behind the tube-plate of the fire-box. The boiler had no appearance that indicated that the explosion had taken place from scarcity of water The engineer, in evidence, declared that he was allowed to carry 85 lb., but there is no doubt but that a much greater pressure than that would be required to tear the boiler in the manner the Shamrock's was torn. The boiler was constructed throughout of $\frac{1}{4}$-inch plate. This, there is no question, is too thin for tube plates. The tubes were wrought iron. From all the circumstances of the case, I have no doubt but the boiler exploded from a too great accumulation of steam, and having either a too small or inefficient safety-valve, they did not allow it to blow off. From this circumstance I was induced to pay some attention to, and, if possible, to improve, *the safety valve.* I send you a sketch of one which I consider does away with many of the objections of the present one in use. It is more especially useful when steam of high pressure is used. If a valve is constructed to be out of the reach of the engineer—that is, to be loaded in the box that contains the valve, if the valve be of any size at all—the weight requires to be enormous, for the pressure is 15, 20, or 30 lb. per inch. In the valve I have invented this objection does not hold, as the same amount of weight will load a 10-inch valve at the same pressure, as it would load on the old plan a valve of 2 in. diameter. The top valve is 10 in. diameter, and the lower one $9\frac{7}{8}$ inch; consequently, the area to be loaded is only a ring 10 inches diameter and one-eighth inch broad. As the Polytechnic Society is established for the advancement of science, I will, if it would be of any service to its members, prepare a paper on marine engineering in this country. The boats attain a speed here, with an economy of fuel as you have as yet not got at home. A boat was started this summer on the St. Lawrence, called the Montreal; she is the fastest in North America. Some engineers visited her here from the Hudson, and they declared they had nothing that surpassed her. She is 250 feet long; breadth, or beam, 27 feet; depth of hold, 10 feet; diameter of cylinder, 57 inches; length of stroke, 10 feet; diameter of wheel, 30 feet; length of float, 10 feet; and depth of float, 2 feet 6 inches; strokes, 21 per minute; steam, 25 lb.; speed, 15 miles per hour!"

Mr. Maitland's valve consists of a very simple and ingenious modification of the common equilibrium valve, now well-known and much used among engineers. Steam from the boiler enters freely a flat chamber, the top and bottom of which are formed by two valves, firmly connected together and both opening upwards. Now if these two valves be of equal diameter, the steam-pressure above the lower valve will exactly counterpoise the pressure beneath the upper valve, consequently the valves will have no tendency to rise, and no steam will be allowed to escape. But if we suppose the upper valve to be even one-eighth of an inch the larger in diameter, the pressure on it will overcome that on the lower valve, and the two valves being connected together they will both rise, and allow the steam rapidly to escape (upward through the upper valve, and downward through the lower one); and it is evident that the weight necessary to load this valve is exceedingly small, viz., just sufficient to balance the pressure on an area equal to the difference between the areas of the two valves, whilst the valve is as efficient as a common safety-valve having an area equal to the sums of the areas of the two valves. The force necessary to keep this valve down is so small that the ordinary lever is dispensed with; and in place of it a weight corresponding to the pressure required is placed immediately upon the top valve, thus preventing a tendency to gag or stick from want of attention, and making the apparatus what it really is—pre-eminently a *safety-valve.*

THE SMOKE NUISANCE.

REPORT OF THE PARLIAMENTARY COMMITTEE.

The select committee appointed to inquire into the means and the expediency of preventing the nuisance of smoke arising from fires or furnaces, and who were empowered to report their opinion, together with the minutes of evidence taken before them, to the House, have considered the matters to them referred, and have agreed to the following report —

In their endeavours to investigate the subject, your committee have deemed it expedient to call before them a variety of persons. They have received the evidence of the most eminent men in the science of chemistry, of practical engineers of high reputation, of leading master manufacturers and proprietors of steam-engines, and of ingenious persons who had devised means and taken out patents for the prevention of smoke. The attention of the parties called to give evidence has been principally directed to the consideration of the following heads, on which their opinions were given.

1. Whether it was practicable entirely to prevent, or very much to diminish, the nuisance now so severely felt in large towns and populous districts from the smoke of furnaces or of steam-engines.

2. Whether, if this were practicable, it would be advisable to take any steps to prevent the nuisance; as so doing might interfere with the property or interests of manufacturers, or of the proprietors of furnaces.

3. If, in the event of the two former questions being answered in the affirmative, they would recommend some legislative enactment to be framed to prohibit the nuisance of smoke.

In regard to the first of these questions, it appears from the whole of the evidence of scientific and practical men, including master manufacturers, that smoke, which is the result of imperfect combustion, may in all cases be much diminished, if not entirely prevented.

It appears to be the unanimous opinion of the witnesses conversant with the subject, that imperfect combustion arises from a deficiency of atmospheric air to mix with and act on the inflammable matter at a proper temperature, and under circumstances which must ensure its effective operation; that this admission of air, properly regulated, is the great, if not the only, principle of preventing smoke which is generally applicable; and that all inventions for the prevention of smoke (except where the smoke has been separated mechanically by an artificial shower of water, produced in a flue constructed for the purpose,) are only various applications, in different forms, of this general principle even the flow or jet of steam which has been applied by some persons to prevent smoke in furnaces, being merely a modification of this general principle; as, though steam may modify combustion, air must necessarily flow in with it, otherwise the combustion in the furnace is arrested.

The evidence before your committee further shows, that the admission of atmospheric air, under proper regulations, into the furnace, is productive of saving in fuel, by causing the particles of carbon, which would otherwise rise in smoke and be wasted, to ignite, and thereby to increase the heat in the boiler.

It appears that the expense attendant on putting up whatever apparatus may be required to prevent smoke arising from furnaces is very trifling; and, as some of the witnesses observed, the outlay may be repaid within the year by the diminished consumption of fuel. For additional information on this subject your committee beg to refer to the evidence.

Several most ingenious patents and inventions for the prevention and consumption of smoke, were laid before your committee, which, from the testimony of the proprietors of furnaces by whom they were adopted, appeared to answer the twofold purpose of preventing smoke and of lessening the quantity of fuel required.

The means of preventing smoke might also be applied to the furnaces of steam boats; but such application would be attended with rather more expense than on land, from the occasional want of space, and the setting of boilers, in a steam-vessel. No doubt, however, existed, in the opinions of

those examined, that the prevention of smoke could be accomplished in all steam-vessels.

The use of anthracite coal and of coke, as the means of preventing smoke, were not overlooked by your committee; but, being well known, need not be repeated here.

In reference to the last and most important point under the consideration of your committee, how far it would be expedient to frame some legislative enactment to lessen the nuisance from smoke, your committee, after a careful survey of the evidence before them, seeing that the evils arising from smoke are severely felt in all populous places, and are likely to increase in proportion as wealth and the use of machinery cause a greater extension of furnaces and steam-engines, come, without hesitation, to the conclusion, that such a legislative enactment should be introduced without delay; and they trust that the perusal of this evidence will ensure cordial aid and co-operation on the part of the proprietors of factories, in accomplishing an object so essential to the comfort and well-being of the surrounding country and population, an expectation which your committee feel justified in entertaining, by the knowledge of the laudable exertions which have lately been made, with much success, by the manufacturers and inhabitants of Leeds and Bradford, in Yorkshire, for the prevention of smoke in those districts.

Your committee have received the most gratifying assurances of the confident hope entertained by several of the highest scientific authorities examined by them, that the same black smoke proceeding from fires in private dwellings, and all other places, may eventually be entirely prevented, either by the adoption of stoves and grates formed for a perfect combustion of the common bituminous coal, or by the use of coke or of anthracite; but they are of opinion, that the present state of knowledge on that subject is not such as to justify any legislative interference with these smaller fires.

In conclusion, therefore, your committee beg leave to recommend that a bill should be brought into parliament at an early period of the next session, to prohibit the production of smoke from furnaces and steam-engines.

They indulge a hope that the matter will be thought of sufficient national importance to induce the government to bring in a bill; but, in the event of their not doing so early next session, your committee recommend that the chairman of this committee should frame such a measure, as being the necessary result of the complete and strong conviction to which they have come by the prosecution of the inquiry.

17th August, 1843.

KYANIZING OF TIMBER.

Sir,—A letter having appeared in your Journal for August, from Mr. Tyrrell Thompson, Secretary to the Anti-Dry-rot (Kyan's) Company, commenting on my report and letter on the preservation of timber from decay, I trust you will allow me a corner in your valuable Journal in answer thereto.

Mr. Thompson says, that I have made statements most injurious to the interests of the Kyanizing Company.

As *secretary* to that company, he is no doubt most anxious about its interests, but I hav[illegible] *zeal*, and have only been anxious to find out the best mode of preserving timber from decay, and the attacks of worm.

Mr. Thompson states that both my report and letter are very inaccurate. Now, Sir, this charge of "inaccuracy" refers chiefly to my statements respecting the decay of sleepers at the West India Dock warehouses, and the wooden tanks in the Kyan Company's yard.

To justify the truth of my statements, I think you will agree with me, that it is only necessary to refer to the published minutes of the discussion at the Institution of Civil Engineers for session, 1842 in which the following appears:—

"Mr. Samuel Seaward said he believed the present method of Kyanizing to be very imperfect, and alluded to a number of sleepers so prepared for the West India Dock warehouses having recently been discovered to decay.

"Mr. Martin (Engineer to the East and West India Docks) confirmed this account of the decay of sleepers. *Fifty out of seventy were destroyed.* They had been prepared by simple immersion, and had been down about five years. He had understood that some of the wooden tanks in which the solution was kept at the Anti-Dry-rot Company's yard were decayed.

"Mr. Bull had prepared considerable quantities of boards for the Calder and Hebble navigation, by immersing them in the solution for two or three days which was about double the period allowed by the patentee. He had some specimens of boards, and in almost all of them there was an appearance of decay in various stages. An oak board one inch thick, Kyanized in 1839, had lain ever since upon the damp ground, exposed to the air; the sap part was entirely decayed, but the heart remained sound; fungus was, however, growing upon it. Poplar boards, Kyanized in 1838, 39, and 40, were all partially decayed. In preparing the timbers, he had always followed the instructions of the patentee, and had tested the strength of the solution with the hydrometer, but had mixed up fresh solution even more frequently than was supposed to be required. On dismantling one of the tanks for holding the solution, he found the iron work partially destroyed, and entirely covered with globules of mercury."

It appears that Mr. Thompson did himself take part in this discussion. Why did he not then contradict the statements, if untrue? or after these minutes had been printed and published in almost every journal in London, why did he not explain them away at the time, instead of reserving his explanations and answer for many months? And even to this moment, in the absence of such explanation, I was, and am now, of course, bound to believe the statements of Mr. Seaward, Mr. Martin, &c. But you will observe, Sir, that he does not, even now, deny the fact of the sleepers and tank having decayed; he only says the sleepers were not in the West India Dock warehouses, but were laid down in Kyan's own yard. In my opinion, this explanation makes the matter worse, because, if the Kyan company's process will not preserve the timber laid down in their own yard, how can they expect that the public will believe that it will preserve timber elsewhere.

Mr. Thompson must be well aware that I could have cited many other instances of its failure; what says that eminent civil engineer, Robert Stephenson, Esq., in his report respecting the sleepers of the London and Birmingham Railway? "They were all Kyanized, but the result has been unfavourable and unsatisfactory, for after laying three years, great numbers discovered symptoms of decay, indeed many have been removed absolutely rotten, and he had abandoned the Kyan's process, and adopted Mr. Bethell's oil of tar.

Why has I. K. Brunel, Esq., C.E. (under whose directions such immense quantities of timber were Kyanized) abandoned it and adopted the oil of tar? Will Mr. Thompson inform us what has become of his Kyanizing tanks at Bristol, and how many loads of timber were Kyanized at Hastings during the last two years, and also at Shoreham? and why were the tanks at the latter place offered at 10*s.* per load to be *converted into oil of tar tanks.*

What says Mr. Thompson to the experiments in the mushroom-house at Welbeck, where good Baltic timber lasted longer than the best Kyanized oak? and will he tell me how many hundreds of Kyanized sleepers on the London and Brighton Railway have decayed?

On the 31st of last month I visited the model-rooms (or museum) of the Admiralty at Somerset House, and examined pieces of Kyanized oak and fir now there, which were placed in the sea at Sheerness, and are perfectly honey-combed and destroyed by the worm.

Dr. Moore proved the same thing at Plymouth: and amongst the *Transactions of Civil Engineers*, is a report from a gentleman at Dover, proving that Kyanized timber shared the same fate there, and that the worms eat it quite as much as they did the unprepared timber. I could bring a host of other proofs if requisite. But I think I have said enough to dispose of Mr. Secretary's first and second heads.

As to the third head—that of the Kyanized timber at Shoreham Harbour—I here most respectfully beg to deny, most positively, that there was a Report and Survey by the Commissioners of Shoreham Harbour; and I say positively, that every piece of Kyanized timber in the piers at Shoreham Harbour—that is, placed at any time during the last five years under high water mark and exposed to the action of tidal water—is gone through several stages of decay, and affected by the worm; and that the oak timber Kyanized is in a worse condition than the unprepared timber.

I have, in my possession, certificates from eminent professors, civil engineers, &c., and from the largest timber merchant and also builder in the port of Shoreham; also from all the carpenters, &c., workmen of Shoreham Harbour, substantiating the above, which I am ready to publish at any time.

As to Mr. Thompson's fourth head, if he had read my letter on Kyanizing carefully, he would have seen that I grounded my opinion as to the injurious effect of the vapour of mercury, on the opinions given to the Admiralty by Sir Humphrey Davy.

In conclusion, allow me to state that my opposition to corrosive sublimate arises alone, which I have publicly announced) from a conviction that in hydraulic works (and it was such works that my letter and report treated upon) it is as useless as soft soap, as it does not prevent decay when exposed to sea water, as hydraulic works generally are.

The importance of the subject of preserving timber, I hope will be a sufficient excuse for the space I have occupied in your *Journal.*

I am, Sir,
Your obedient servant,
William B. Prichard.

Health of Liverpool.—On the occasion of Dr. Lyon Playfair proceeding to Liverpool to examine into the causes of the great unhealthiness of that northern metropolis, Mr. Henry Laxton, has addressed to him a short pamphlet, in which he ably lays bare the prominent causes of the evil, and suggests the requisite improvements. He attributes the unfavourable state of Liverpool, as regards health, principally to the following causes: open cesspools; proximity of buildings; inefficient drainage; smoke from factories and steam vessels; cellar occupation, and dirty state of buildings; open spaces, where water and refuse are allowed to collect and decompose; inefficient supply of water, and deficiency of pleasure grounds for the school children.

THE RELATIVE EFFICIENCY OF LONG AND SHORT CONNECTING RODS, CONSIDERED IN THE EXPOSITION OF CRANK AND CONNECTING ROD MOTION.

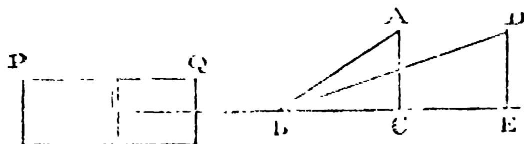
By H. F. Clifford.

The subject of the following paper is one of great importance to the practical mechanic; and as we have never yet seen any satisfactory solution of this long disputed question, we have endeavoured to draw such conclusions from the investigation of the theory of crank and connecting rod motion as we feel convinced will set at rest all previous doubts concerning the comparative advantages of long and short connecting rods. With a given force in the direction of the piston, our object in the present investigation is to ascertain the best means of obtaining the greatest amount of that force in the direction of rotation, and thus render friction as small as possible; in other words, whether is a short or long connecting rod the more effectual method for fulfilling the conditions of our proposed inquiry?

We shall first show that if F be the original force excited by the piston rod of a steam engine along its own axis, that there is more of that force transmitted in *the direction* of the long rod than the short one.

Let P Q, Fig. 1, be a cylinder with piston, and let the piston rod exert a force F, at the point B, where the rods B A, B D, connect it respectively to the cranks A C, D E.

Fig. 1.



Let A B make an angle (ϕ) with the horizon.
B D .. (θ) ..

The resolved part of F { in the direction of A B = F cos ϕ.
B D = F cos θ.

Now the magnitude of the force in either direction depends on the cosines of the angles, which the respective rods A B, B D, make with the horizon, and since cos ϕ and cos θ become a maximum when ϕ and $\theta = o$, it follows the smaller the angle the larger the numerical value of the cosine, and since θ is considerably less than ϕ, the long rod has evidently more of the resolved part of F in its direction than the short one.

Again—

The resolved part of F { in the direction of A C = F sin ϕ.
D E = F sin θ.

The magnitude of the forces in this case depends upon the sines of the angles, and since the larger the angle the greater the sine, the resolved part of F in A C, is much greater than that in D E: in other words, the pressure into the centre, or friction in the axle, is more in the short than in the long rod.

Having proved then that there is more force in the *direction* of the long rod, we now proceed to show that *the resolved part of the force in* B A, and B D, *in the* direction of rotation, is greater in the case of the long than the short rod; or,

Proposition. To find the part of the force exerted by the piston rod of a steam engine which is perpendicular to the crank, in any given position of the fly.

Let E A, Fig. 2, be the piston rod, the direction of which produced is supposed to pass through the centre of the fly C; A B, the connecting rod; C B, the crank: B T D, the tangent at B.

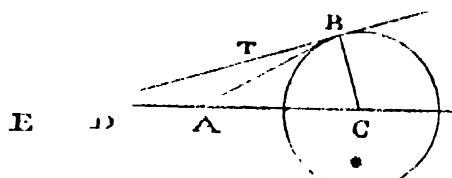
Let C B = a, A B = b, A C B = θ, B D = x, A D = z.
∠ A B D = ϕ, ∠ the tangent makes with connecting rod A B.

The resolved part of F in B A = F cos B A C.

$$= \text{F} \cos (\text{A D B} + \text{A B D.})$$
$$= \text{F} \cos \left(\phi + \frac{\pi}{2} - \theta\right)$$
$$= \text{F} \sin (\theta - \phi)$$
$$= f \text{ suppose.}$$

The resolved part of F in B D = $f \cos \phi$.
$$= \text{F} \cos \phi \sin (\theta - \phi) \qquad \text{A*}$$

Fig. 2.



Investigating equation A, it is evident that the smaller the angle ϕ the greater the force in B D, and the longer the rod A B, the smaller the angle it makes with the tangent, and thus we have more of the resolved part of the force in B A, in the direction of rotation in the long rod, *à fortiori*, how much more have we of the original force F, transmitted by the piston in the direction of rotation in the case of the long than the short rod.

There is, however, a small arc in the crank's orbit, in which the short rod possesses an advantage, for let E B, F B, be respectively a long and short connecting rod, A G H, the fly, G C H, perpendicular to A E, and let the crank (in Fig. 3) be in such a position that B T, the tangent, bisects the ∠ between the rods; let D be the point correspond-

* The solution of this equation is rather intricate, as we have to express the value of F in B D, in terms of the known quantities θ, a, and b; but, as it is desirable to know the result, we give the working.

$$\text{Now } \cos \phi = \frac{b^2 + z^2 - x^2}{2bz} \qquad 1.$$

$$x = \text{B D} = \text{B C} \tan \theta = a \tan \theta.$$

$$\frac{z}{\text{A B}} = \frac{\sin \phi}{\sin \text{A D B}} = \frac{\sin \phi}{\sin \left(\frac{\pi}{2} - \theta\right)} = \frac{\sin \phi}{\cos \theta}.$$

$$\therefore z = b \frac{\sin \phi}{\cos \theta} = b \sin. \phi \sec. \theta.$$

By substitution in equation 1, we have

$$\text{Cos. } \phi = \frac{b^2 + a^2 \tan.^2 \theta - b^2 \sin.^2 \phi \sec.^2 \theta.}{2ab \tan. \theta}$$

$$\therefore 2\,ab \tan. \theta \cos. \phi = b^2 + a^2 \tan.^2 \theta - b^2 \sec.^2 \theta\,(1 - \cos.^2 \phi.)$$
$$\therefore b^2 \cos.^2 \phi \sec.^2 \theta - 2ab \tan. \theta \cos. \phi = (b^2 - a^2) \tan.^2 \theta.$$

Dividing by $b^2 \sec.^2 \theta$ and putting $\frac{a}{b} = 2m$, we have

$$\text{Cos.}^2 \phi - 2\,m \sin. 2\,\theta \cos. \phi = (1 - 4\,m^2) \sin.^2 \theta$$

Completing the quadratic and extracting the root } $\cos. \phi = m \sin. 2\,\theta \pm \sin. \theta \sqrt{1 - 4\,m^2 \sin.^2 \theta}.$

Now the positive sign must be taken in order that cos. ϕ may be always possible.

$$\therefore \text{Cos. } \phi = m \sin. 2\,\theta + \sin. \theta \sqrt{1 - 4\,m^2 \sin.^2 \theta},$$

$$\text{And } \sin. \phi = \sqrt{\cos.^2 \theta - 4\,m \sin.^2 \theta\,(m \cos. 2\,\theta + \cos. \theta) \sqrt{1 - 4\,m^2 \sin.^2 \theta}}.$$

Let X = the resolved part of f, in B E,

then from equation A, X = F cos. ϕ sin. ($\theta - \phi$.)
$$= \text{F} \sin. \theta \cos.^2 \phi - \text{F} \cos. \theta \sin. \phi \cos. \phi.$$

Putting for sin. ϕ and cos. ϕ their respective values, $\text{X} = \text{F} \sin.^3 \theta \left\{ 1 + 4\,m\,(m \cos. 2\,\theta + \cos. \theta \sqrt{1 - 4\,m^2 \sin.^2 \theta}) \right\} - \text{F} \cos. \theta \sin. \theta\,(2\,m \cos. \theta + \sqrt{1 - 4\,m^2 \sin.^2 \theta}) \sqrt{\cos.^2 \theta - 4\,m \sin.^2 \theta\,(m \cos. 2\,\theta + \cos. \theta \sqrt{1 - 4\,m^2 \sin.^2 \theta}}$,

which is the required equation.

Fig. 3.

ing to B on the other side of E A, then the points B D, will evidently lie between G and K, and R and H. Let C P (in Figs. 4 & 5) represent the other position of the crank, and let P T be the tangent at P. First

Fig. 4

suppose the forces exerted by the connecting rods in their *own directions* to be equal, then it is clear (in Fig. 3) their resolved parts in the tangent will be equal, since ∠ E B T   ∠ F B T. Now from Fig. 5, it will be seen, that while the crank moves from B to K and from K to D, the short rod makes a smaller angle with the tangent than the long one, consequently, through this arc, the short one possesses an advantage; but, on the other hand, in Fig. 4, while the crank moves from A to B, and by parity of reasoning, from D to A, the long connecting rod makes the smaller angle. Hence, if we suppose the forces exerted by the rods in their own directions to be equal, the long rod is preferable, since in a whole revolution of the crank, it has the advantage through the arc D A B, which is ≥ arc B K D, through which the shorter one has the advantage. But the forces exerted by the rods in their own directions are not equal, since if F be the force exerted by the piston F cos P E F, the force in the direction of the long rod is always greater than F cos P F C, the force in the direction of the shorter one, except when P coincides with A or K, when they are equal, and thus the superiority of the long rod in the entire orbit in *the transmission of rotary force*, has been satisfactorily demonstrated. Lastly, since the resolved part which produces rotation is greater in the long than the short rod, the resolved part perpendicular to this direction, or tending to the centre of the fly, is less in the long than the short rod; and this resolved part produces friction on the axis of the fly, which is the chief thing to be guarded against.

It is this trifling advantage possessed by the short rod that has induced several clever practical mechanics, with whom we are acquainted, to argue in favour of its superiority; but, whilst we agree with them, that it has the property of pressing at a more favourable angle during the progress of the crank through a very small arc, they must not forget the gradual increase and decrease of the force exerted by the piston on either side of the dead power point R,† *the inequality of the forces in their own directions, and that, moreover, this alleged superiority lasts only during a very limited portion of the crank's entire revolution.*

Theoretically speaking then, there is no limit to the length of the connecting rod of a steam engine, but in practice, we are generally confined for space in the erection of machinery; still from the preceding analysis, we should endeavour to make it as long as we conveniently can, in order to obtain the greatest amount of rotatory force, and thus render friction as little as possible. This subject might be practically illustrated, by taking a steam cylinder, furnished with the usual appendages, and connecting the piston rod end to the crank with a rod fitted with a long eye or slot, so that the length of the rod could be adjusted at pleasure. On the crank shaft put a small drum, and suspend a heavy weight, that has to be wound up over it. By comparing the work done in a given time with the same amount of steam from the boiler, (at an equal pressure in either case,) it will be found that the result of the experiment, if accurately performed, will fully attest the superiority of the long rod, as shown in our theoretical deductions.

THE BRITISH MUSEUM.

New events produce new institutions. In the beginning of this century it would have been considered a silly freak of the swinish herd to have required the inspection of any architectural design, their functions being limited to mute and confiding admiration, when the doctors had given their fiat that the plaster palace or warehouse church was a master-piece of art. What did the public know of art, and what right had they to interfere? Would they have been allowed to pass their comments on the lath and plaster palace in Buckingham swamp? Certainly not! Neither did architects in those days consider it necessary to pay deference to the judgment of the public or of any one else. It was quite enough that they were employed to do the job, and they put it out of the way in the quietest manner that they could, received the money, and posterity will neither care for the architect nor edifice. The increasing attention paid to English art under the auspices of George III. and George IV. led to the regeneration of public feeling with regard to art, and to those efforts which have been made of late years for the cultivation of the public taste; and as the public have obtained a higher qualification, so they have necessarily required the exercise of higher powers. The throwing open of the British Museum, the extension of the school in it, and the establishment of the National Gallery, have opened the way, which has been followed up by subsequent measures, and it is no exaggeration now to say, that the public have twenty times the power of artistic instruction which they had twenty years ago. The mechanics' institutions have co-operated in this movement by the formation of drawing classes; and the delivery of lectures on art, the extension of provincial exhibitions, or the establishment of art-unions, have fostered the public disposition on the subject. Neither has the government less co-operated; the improvements effected at Hampton Court, the better administration of public collections, the institution of schools of design, and the introduction of drawing as a branch of primary instruction, have all had the same tendency. Contemporaneously a demand has been made on public grounds, on those authorities having charge of new constructions, that the designs should be submitted to public competition and public inspection, and the principle of responsibility to the public voice in the case of architectural works has been fully established. Acted upon by the government with respect to that glorious monument, the New Palace of the Houses of Parliament at Westminster, that principle has been carried out in a most satisfactory manner in the exhibition of the Cartoons, for the

† The circumstance of the piston's motion not being uniform is also in our favour, since the force exerted varies from zero to a maximum, as the piston travels from K to G and from K to H; and whilst this fact renders the advantage spoken of still more trifling, we have the long rod exercising the superiority at a time when the piston's exertion is a maximum.

interior decorations. That this principle cannot be injurious to the artist, we are prepared to affirm; that it must have a beneficial influence, the competition to which we have just alluded has fully proved. The incentive to exertion, the sentiment of responsibility, the foretaste of success, which the artist already feels, all tend to develop the highest faculties, and to produce the noblest works. We cannot, perhaps, in this day, reproduce the feeling of religious responsibility which animated the artists of old, and the want of which has been one great cause of the deadness of modern art; we must, therefore, avail ourselves of the nearest approach which the institutions of the present day afford. The vitality of this principle is thus established, and its general application a matter of necessity. We have already alluded to the happy effects of public responsibility in the case of the Houses of Parliament; we now demand its application in an edifice scarcely less remarkable, and not less popular—we mean the British Museum. This is peculiarly the palace of the people, and it is not unnatural that deep interest should be felt as to the designs contemplated for the approaching completion of this edifice, affording, as it will, in its façade, the opportunity for great architectural display, and having the resources of government available for the purpose. We consider it most essential, both as a matter of principle and expediency that some satisfaction should be given to the public anxiety by the announcement and exhibition of the intended design. These are the views which we most earnestly beg to impress on the proper authorities, and we confidently hope for every attention to the many expressions of the public voice on this subject.

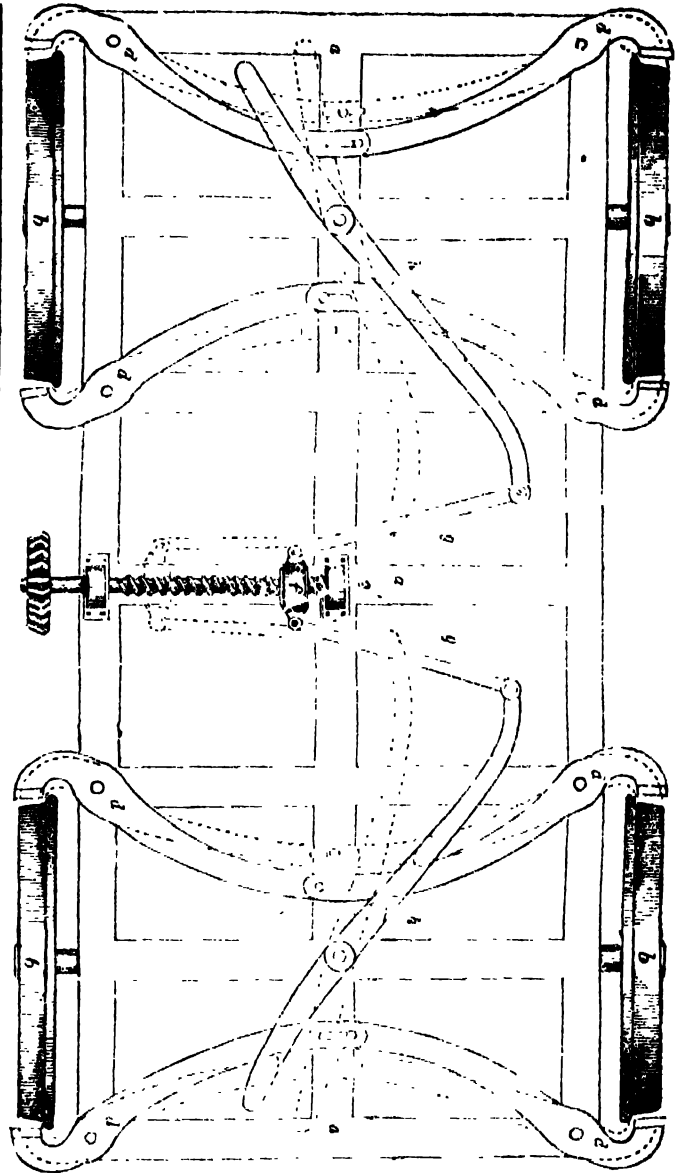
DAVIES' RAILWAY CARRIAGE BREAK.

This railway break has now had a long trial on the London and Birmingham Railway, where it has been adopted to some of the carriages with great success, and has been highly approved on the line. It is the invention of Mr. David Davies, of Wigmore Street, Cavendish Square, who is well-known as an extensive railway carriage builder. The following description, by a reference to the accompanying engraving, which we copy from the *Mechanics' Magazine*, will fully explain the action of the breaks.

a a represent the underside of the framing of a railway carriage; *b b* are the four wheels; *c c* are breaks on the extremeties of eight long levers, whose fulcra are at *d d*; *e e* is a shaft carrying a shaft carrying a quick threaded screw, working in fixed bearings, and furnished with a bevil wheel *e*, for connecting it with a vertical shaft and handle, led off to any point at which it may be convenient for the breaksman to be stationed; *f*, is a traversing nut, attached by the connecting rods *g g*, to the two cross levers *h h*. There are two mortices in each of the cross levers, through which the break levers pass; these levers are connected by a pin on the extremity of one lever sliding in a slot in an iron plate on the end of that opposite to it, so that any motion conveyed to the one, is simultaneously communicated to the other.

Motion being given to the screw *e e*, the traversing nut *f* is drawn towards the bevil wheel, which causes the several levers to assume the position shown by the dotted lines, which will occasion the breaks *c c* to press against the circumference of all four of the wheels with immense force, preventing their rotation and converting the carriage into a perfect sledge. This combination of the mechanical powers is so favourable to the development of power, that with such an arrangement it would be almost possible to crush the wheels. In all the breaks we have hitherto seen, there has always been a violent thrust between the wheel and the carriage, or between two of the wheels, tending to break or bend the axles; in the present plan there is not the slightest strain upon the axle, the gripe being exerted on the two opposite sides of the wheel, and the force that might be thus applied with perfect safety, would be sufficient, if applied in the usual manner, to cause an inevitable rupture in the machinery. Although the action of this break is rapid, it is by no means so sudden as to entail any evil upon that account.

In illustration of the power of such a system of breaks, let us suppose that each of the breaks *c* presents a surface of only three times the area of the bearing surface of the wheel upon the rail, and that the total weight of the carriage is ten tons; it follows then that if each of the eight breaks were pressed against the circumference of the wheel with a force of little more than eight hundred weight, rotation of the wheels would be effectually prevented. When it is further seen that this small force is exerted through the medium of a screw, acting upon a system of levers most advantageously disposed for the multiplication of power, it will be evident that the application of a few pounds to the break handle would instantly arrest the progress of the wheels.



NEW BUILDING ACT.

We have a copy of the last bill as amended, and we are happy to announce that in this the amendments suggested by ourselves and others have been fully carried out, and the bill in its present shape, with a few trifling alterations, we should be happy to see passed. As, however, the bill is again referred for further consideration and amendment to Mr. George Smith, one of the city district surveyors, and architect to the Mercers' Company, Professor Hosking and Mr. Thos. Cubitt, the builder, all well known for their practical attainments, we defer going again into the details of the measure until we see the result of their labours and recommendations, which is to be presented to Parliament in the ensuing session. We cannot conclude these few remarks without expressing the obligations under which the profession are to Lord Lincoln, for the readiness he showed to enter into the free discussion of the details of the first bill, and to amend its defects.

REVIEWS.

ARCHITECTURE IN THE REIGN OF GEORGE III.

The Pictorial History of England. Part 74.

From a condensed popular sketch very much is not to be expected, because the writer is so cramped as to space, that he can hardly do more than touch upon a few leading generalities and summing up of his opinions—certainly has no room for entering into specific criticism, nor always for fully explaining his meaning. We can accordingly look for little more than bare opinions and critical dicta, which must be acquiesced in as of oracular authority by those who are unable to examine into them. Still, even to those who are already familiar with the subject, an *apperçu* of the kind is interesting if only as refreshing the memory, and it would be strange, indeed, if some fresh remark or other could not be picked up from it. Let us begin by quoting the following introductory one.

"The English school, as it was constituted at the accession of George III, could devise no correction of the errors of their predecessors, but by resorting to crude imitations of Palladio, a recurrence to forms and combinations established under other modes of existence totally different from their own, at another period and in another climate. Neither their discriminating taste in the selection of the beautiful, nor their profound knowledge of the practice of the Italian schools, can redeem the want of *fitness* which characterizes their productions, their disregard of the exigencies of our climate, and their inattention to our domestic habits; for in many cases their plans as well as their elevations are borrowed from the Italian. The consequences were fatal. They had rooted up a vigorous plant for an exotic which they wanted skill to naturalize; it perished, therefore, leaving nothing in its place, and another half century found architecture in England reduced to a condition unprecedented since its first development as an art, devoid of unity, character, and principles."

While this is, in the main, true, it is also somewhat vague and indistinct; and to us it appears to partake of contradiction to speak of the discriminating taste, and the profound knowledge of the Italian schools, possessed by persons who resorted to "crude imitations of Palladio." Feeble as may have been their powers of invention, it is strange that those who it seems were acquainted with, and capable of appreciating, Italian architecture generally, should not have extended their views beyond Palladio and other system-mongers. And if, in regard to this point, we find ourselves somewhat at a loss, still less do we comprehend what the writer is driving at when, if we do not mistake his meaning, he gives it as his opinion that, being adapted to a different climate, the architecture of Italy is essentially unfitted to be followed by us—at least without very considerable modifications. It may be so, but we have yet to learn wherefore; for though this *philosophical* remark is a pretty old acquaintance of ours, we having met with it we know not how many times before, never have we met with even an attempt at an explanation of it. Hardly is there any thing in the constitution of such a style that unfits it in any degree for application in almost any part of Europe. It provides as effectually against weather as any mode of building can do, and therefore the difference of climate must be corrected by other means; instead of marble pavements or inlaid floor, we require thick carpets, good fires, stoves in vestibules, and the like: and instead of sitting with open windows, we are glad to keep them shut. But matters and circumstances of this kind have nothing to do with one mode of building more than another. From what is sometimes said on the subject, it might almost be supposed that every ten degrees of latitude would require quite a different mode of architecture; and also might it be supposed that the climate of England was as severe as that of the most northern parts of Siberia. Changeable enough it is, no doubt, and such being the case, it is impossible to fix upon any mode of building that shall be perfectly suitable as regards all the fluctuating contingences of weather: we have seasons when shade is as inviting as in Italy, and when even the splashing of fountains in marble halls would be a luxury, and when consequently Italian architecture—supposing that is at all concerned with the matter, would be felt to be—for the time at least—the most appropriate of any for ourselves.

Let us test the "climate doctrine" by facts: what say they; is St. Paul's found to be at all worse adapted to our climate than Westminster Abbey? Is Windsor Castle decidedly better so than Buckingham Palace? Are Barry's clubhouses found to be at variance with aught our climate requires? or though they give us the very quintessence of the Italian style, are they not perfectly English in accommodation—as thoroughly or rather infinitely more so than many houses, and very costly ones, too, which exhibit no other style externally than that called the hole-in-the-wall style? Still, our climate, it may be argued, does not admit of arcades and colonnades; why not?—or if not, then our own old English architecture was badly contrived, for that gives us specimens of cloisters and covered walks, which are essentially the same things as the others, differing from them only in style and in name.

The fault lies not in adopting the Italian style—Palladian or any other particular species of it, but in not at the same time *adapting* it to circumstances, and further improving it. And if this be what the writer means, we agree with him, at the same time wishing he had expressed himself more clearly than he has done. Fully do we agree with him in regard to his representation of the state of architecture in this country at about the commencement of the present century. With very few exceptions, indeed, it was deplorable enough: the art may be said to have been in a state of starvation—reduced to the extreme of meagreness and insipidity. Of this, we have most convincing proof, in the *New Vitruvius Britannicus*, which consists entirely of buildings of that period, most of them below mediocrity in point of taste and design, and all, more or less, infected with beggarly mannerism and false simplicity, and marked by nothing so much as the utter absence of all artist-like feeling or study. Even where the glimmering of an idea seems to have presented itself, nothing is made of it; nor is there among the whole collection a single design that is even decently finished-up. The Adams, the Wyatts, and the Bonomis, bedevilled and vulgarized architecture: in their hands, tawdriness, frivolity, dullness, and meanness, became its characteristics. In order to escape the reproach of heaviness, they fell into the opposite extreme of flimsiness; while of simplicity they seem to have had little other idea than nakedness of composition, scantiness of details, and utter disregard of finish—that *sine qua non* in the æsthetics of architecture, let the style itself be what it may. Even when they aimed at richness, the result was seldom more than a sort of *niggling* prettiness; nor was that always consistently kept up. With the Adams, such was generally notoriously the case: their designs, for the most part, exhibit trumpery ornament, patched upon buildings that were not even prepared for embellishment of any kind, being in themselves quite in a state of nudity, as is strikingly the case with the Adelphi, Caen Wood, &c., which are wretched architectural stuff, hardly a degree better in point of taste than our modern gin-palace style. "In the screen of the Admiralty," says the writer in the *Pictorial History*, "Adam surpassed himself. It is a work of great beauty, independently of being the only instance in which he adopted a recognized style in the detail." As to its having much positive merit, however, we do not agree; on the contrary, our opinion more fully coincides with that expressed by another critic, in the *London Interiors*, Part 23, who speaking of the Admiralty screen, says, "It neither agrees in any way with the building to which it is attached, nor is it on a sufficient scale to be at all suitable as a frontispiece to a public edifice; for it looks too much like a reduced copy of what was intended to be nearly double—or speaking more correctly, nearly four times the size, or about 250 feet in length by 45 in height, instead of only 130 by 22." And again, "As far as the Doric colonnades themselves go, they are satisfactory enough, but not so the centre compartment, forming the gateway; for it is poor in its general character, and too much cut up, especially by the plain blank windows or panels in the piers, which while they destroy width (breadth) of surface, produce an appearance of poverty—of the absence of decoration rather than of richness: another more egregious and evident defect is, that over the arch, the architrave and frieze of entablature, otherwise continued thoughout, are omitted, and thus the entablature is maimed and mutilated in the very chief point of the design!"

Adam may very deservedly be commended for one thing—the study he bestowed on his plans, and for the greatly improved, more convenient, and likewise more effective arrangements which he introduced into the interior of houses, thereby contributing to the bettering our domestic architecture, in a very essential point; but as an artist, his taste was even at the best of a very namby-pamby kind.

James Wyatt was in some respects a sort of Adam *riformato*. It was his good fortune to make a decided "hit" by his first work, the Pantheon, in Oxford Street, as to which we are unable to speak, never having seen any designs of it—for none are given in the *New Vitruvius Britannicus*, although that work contains one or two specimens of his, and those not particularly favourable ones;—yet if we may judge from the view of the large room, given in the *Pictorial England*, where it is styled "a noble conception," we should say that it must have been a strangely disjointed and incongruous piece of design, built up with columns in some places, while there were absolute gaps in others. However, the Pantheon was the resort of fashion; the *place* itself was no doubt splendid and gay enough; and when fashion is determined to be pleased, it is generally a very little indeed

that will please it. It was the fashion of the day to admire the Pantheon, and Wyatt forthwith became all at once the fashionable architect *par excellence*. Business poured in upon him, and he treated it as business; his business was to please his customers, and please them he did, very much, in several instances, to the displeasure of posterity, for he has since received some hearty maledictions from both architects and antiquaries—from one more especially, who has branded him as "James Wyatt of execrable memory." No doubt very great allowance is to be made for him, when it is considered that the study of Gothic architecture was then quite in its infancy, and even the rudiments of that style scarcely at all understood. Besides, Wyatt did something, were it merely the helping to bring forward that styl into notice again, and so far he is justly entitled to a prominent station in the history of the English architecture of the 18th century, albeit, Mr. Gwilt has carefully suppressed his name, while he records such men as Paine and Bonomi. Without any great loss to his fame, much of Wyatt's Gothic has since perished; the castellated palace at Kew—a whim of George III., the House of Lords, and his works at Windsor Castle, have all been swept away, and Fonthill is now a mere wreck; therefore Ashridge is now one of the chief mansions remaining, which he did in that style. Less excuse than for his Gothic can be offered for what he did in the Grecian or modern style, and which is for the most part very mannered and tame. In fact, much as he was favoured by opportunities, Wyatt achieved no really great work, or such as would entitle him to much distinction at the present day, and probably did much less in one sense than he might have accomplished, had his engagements been fewer. He was, too, in one respect singularly unfortunate, for if his Pantheon at all merited the exaggerated praises bestowed upon it, it did not remain long enough to obtain the suffrages and the admiration of posterity, being burnt down about twenty years after it was first erected, and as we have already remarked, no satisfactory memorials of it remain.

Fortunate would it be for the reputation of George Dance, were the front he bestowed upon Guildhall, to disappear as completely as so many of Wyatt's productions have done; for it is a sad blot in his professional scutcheon—so utterly tasteless in itself, independently of its absurdity as an imitation of Gothic, that it is difficult to believe such a piece of architectural "balaam" could have been perpetrated by the man who gave us an edifice so stamped with character and artistic feeling as Newgate. In this last the centre or keeper's house is, however, comparatively a failure: had there been only three instead of five windows on a floor, the effect, not only of that part, but of the whole exterior would have been decidedly better; the original design has besides been greviously impaired by the present miserable attic story substituted for the pediment which crowned that part of the structure, and both harmonized and contrasted so admirably with the rest. Neither Newgate, however, nor the Giltspur Street Compter (which is also by Dance) obtained a place in the *Vitruvius Britannicus*, before referred to; although we there find both the Clerkenwell Sessions House, and the Trinity House—the latter by Samuel Wyatt the brother of James, and a building possessing more of mere prettiness than of either dignity or beauty; whose windows are strangely disproportioned to the order, and the dressings of some of them exceedingly scanty—in fact, little better than a few meagre mouldings.

Though the names of several architects are mentioned by him, the writer of the sketch in the *Pictorial England* scarcely adds any information respecting them, and he is very sparing of dates. In one instance, indeed, we learn from him what we were not aware of before, namely, that the India House is not by the person to whom it has hitherto been universally ascribed; for we are here told—

"Henry Holland was distinguished by the patronage of George Prince of Wales, who prefigured the sort of encouragement the future monarch was likely to bestow upon the arts, by employing him upon that extensive structure of lath and tiles, the Pavilion at Brighton. In 1784, he altered Carlton House, and to him was due the façade, pleasing and harmonious in all its proportions and details, with its beautiful portico, turned to a legitimate purpose by affording shelter for carriages. Holland built Drury Lane Theatre, destroyed by fire in 1809; and the façade and hall of Melbourne House at Whitehall, which remains a memorial of his refined taste. He was likewise *the author of the India House*, usually attributed to Jupp, who was surveyor to the company at the time it was built. It is a common-place design, and the portico ill-assorted to the wings; but porticos were now coming into vogue, which made the impropriety of their association a matter of no importance."

This last observation is just enough, for we have since had porticos stuck to almost every thing of any size—even to Bedlam, and that not only with utter disregard of propriety as to purpose or character, but so as to be completely at variance with all the rest. We are glad to find honourable mention made of the façade of Melbourne, now Dover House: it is, indeed, upon far too small a scale to tell at all to advantage, where it is placed, for it there shows as a mere bit, and is in fact so small, that the intercolumniation of the portico is of necessity much wider than it ought to be: still it is marked by much elegance of taste, classical feeling, and artistical quality. Nevertheless, this piece of design is excluded from the *New Vitruvius Britannicus*, and the same is also the case with Carlton House, while so many uninteresting and exceedingly poor subjects are admitted into it.

We shall probably return to the subject when it is resumed in the *Pictorial* with reference to which we have been speaking; and we suppose that the next chapter of the kind will be the final one, and will continue the history of English architecture down to the end of the first quarter of the present century.

Marine Steam Engines in the Royal Navy.

A letter has been addressed to the Lords of the Admiralty on this subject, and printed, which is likely to excite a good deal of public attention and much controversy among the members of the engineering profession. Mr. Alexander Gordon, the author of it, is, it is well known, the agent of Napier of Glasgow, and consequently, as he suggests, his testimony is open to the imputation of some bias, and he has been induced to bring forward this pamphlet on the occasion of some Parliamentary returns, which he has obtained through the medium of the Hon. Captain Gore. We need scarcely say that the statistics of marine steam-engines are of great importance, both to the nation and the mercantile interests, and particularly at a period when one-fourth of our coasting trade is carried on by the means of steam vessels, and when there is such certain prospect of its still farther increase. The deficiency of steam statistics, is, however notorious; and those obtained by Mr. Gordon and Captain Gore are not calculated to alleviate the evil. They are, as we shall subsequently show, deficient in the most important details, and arranged so as to produce particular inferences. If they were not intended to suit particular objects, why is it that the return is limited to the vessels named in the order, and not extended to all vessels contracted for within the period of the last ten years? Had this been done, we should have had the *Medea*, *Hydra*, *Gorgon*, *Driver*, and others, now all kept carefully out of sight, but most necessary for the purpose of instituting any fair comparison, or deducing sound conclusions. Why have we not the dimensions of the engines, the tonnage and dimensions of the vessels, and the consumption of coals?

Again, we have a return of the cost of repairs without any statement of the service on which the vessel has been placed, whether in war service or merely steaming about the coast. Mr. Gordon has himself said enough to show the many circumstances which interfere to prevent a fair comparison being drawn, or fair play being given to machinery; but there are many others no less calculated to show the danger of a comparison of the value of a vessel from the cost for repairs, when the circumstance of the expediency of a vessel is calculated to put it on more severe service, and thus render greater repairs necessary, while an inefficient vessel is shelfed, and thus has neither service nor repairs.

Under all these circumstances we must protest against any inference being drawn from these *very* suspicious returns—so incomplete that on their appearance they deterred us from making use of them. That the government have unconsciously lent themselves to this imperfect mode of inquiry we are convinced, and we trust they will not leave it to individual members of the House in the ensuing session to perpetuate this system, but that they will render that protection to the marine engineers of the country by the publication of accurate and comprehensive returns, which are imperative as an act of justice, after a statement so very injurious, from its incompleteness, has been put forth to the world. We call for this as an act of justice to the marine engine builders of the Thames, the Mersey, and the Clyde, and as a communication of information rendered indispensable by the growing wants of the commercial steam marine, and by the necessity of enlightenment upon this subject to the government itself. Within the last three years not less a sum than 2,000,000 have been expended by the government and the great steam ship companies upon the construction of vessels of the largest class and greatest power. A vast annual expenditure under this head has now commenced, and, as a matter of national economy, it is expedient that we should be able to profit by all the experience of the past. Let us have the dimensions and weights of the engines, the number of strokes they perform, the mean velocity of the vessel, the quantity of fuel consumed, the length of engine room, the contract price, the tonnage and dimensions of the vessel, the peculiar service for which intended (as the Niger expedition,) for instance, what service the vessel

	ALECTO.	PROMETHEUS.	POLYPHEMUS.	GEYSER.	CYCLOPS.	VESUVIUS.	STROMBOLI.	DEVASTATION.
Names of engineers	Seaward	Seaward	Seaward	Seaward	Seaward	R. Napier	R. Napier	Maudslay
Original contract	£10,700	£10,700	£10,700	£13,933	£22,103	£13,480	£13,480	£18,650
Extras on ditto	£297	£315	£211	£110	£906	£100	Nil.	£681
Cost of repairs	£1158	£1012	£210	£89	£800	£38	£68	£249
Repairs up to 31st March, 1843, from	Jan. 1840	March 1840	June 1841	July 1842	Oct. 1840	Oct. 1840	Sep. 1840	Dec. 1841
No. of days incapable of working in consequence of repairs	393	353	162	50	164	38	51	92
No. and diameter of cylinders	Two, 53 in.	Two, 53 in.	Two, 53 in.	Two, 62 in.	Two, 64 in.	Two, 63 in.	Two, 63 in.	Four, 54¼ in.
Length of stroke	4 ft. 6 in.	4 ft. 6 in.	4 ft. 6 in.	5 ft. 3 in.	5 ft. 6 in.	6 ft.	6 ft.	6 ft.
Nominal horse power, velocity of piston 210 ft. per minute	200	200	200	268	286	280	280	410
Diameter of paddle-wheel	26 ft.	26 ft.	26 ft.	26 ft.	27 ft.	26 ft. 6 in.	26 ft. 6 in.	27 ft.
Breadth of board	7 ft. 5 in.	7 ft. 5 in.	7 ft. 5 in.	..	7 ft. 2 in.	7 ft. 9 in.	7 ft. 9 in.	8 ft. 7 in.
Depth of boards	1 ft. 2 in.	1 ft. 2 in.	1 ft. 2 in.	..	1 ft. 5 in.	2 ft. 2 in.	2 ft. 2 in.	1 ft. 8 in.
Contract price per horse	£53 10	£53 10	£53 10	£52	£78	£48	£48	£45 5

In the above table we have added to the government returns the dimensions of the engines.

has been upon, and if it be possible to obtain it through the government engineers, let us know what was the cause of so much delay in the repairs as appears in the returns, and whether the repairs were executed by the government or the engineers. We shall then have some materials from which to judge of the comparative merits of each vessel. We shall also be able to appreciate which engines are the most serviceable—whether the beam or direct action engine be preferable. It is time, indeed, that this question should be settled, for government have now had, or ought to have, some experience on the subject. We know that the beam engine is still the favourite with most of our principal engineers, if not all of them; nevertheless, they all manufacture direct action engines, and several of them have taken out patents. If you ask why they manufacture them, they will tell you the government will have them, and they must comply.

We perfectly agree with Mr. Gordon as to the demerits of the late system of contracting, and think it requires great reformation. Mr. Gordon, in the character of a disappointed candidate, makes fierce onslaught upon it, and deals in home charges, on the Admiralty mismanagements, which is palpable. Hitherto the system of contract has had all the appearance of favouritism, and if persisted in must lie open to the same imputation for the future. We are not, however, inclined, neither does Mr. Gordon seem to be, at present, to throw the tenders open for public competition; but we would have the Government make application to all those firms which are known for their workmanship, whether in London, Liverpool, Scotland, or elsewhere. Mr. Gordon tells us that

"The manner in which tenders are called for, opened, and treated, is worthy of some notice. The contracts for marine engines are made in a manner quite peculiar, unlike all other contracts for the public service. They are made at that office in the Admiralty where no other contracts are made for any of the many supplies and stores for the navy.

"The tenders are, or have often been, opened not in one day and hour, but without regard to the strict rules of tender and contract known and practised in other departments of Government. The clause sometimes thought necessary for protecting the public, viz. that the Board does not bind itself to take the lowest tender, has not been inserted in the application, and the lowest tenderers have been disappointed.

"After tenders have been given in, and after some of the contracts have been made, favoured ones of these very contractors have been allowed to tender for more engines, as in the year 1840, when a London house, having obtained an order for two or three pairs of engines, obtained a further order for two more pairs of engines in the following October by reducing their tender, making orders for five pairs of engines, &c. at one time; no other engineers having had any chance of amending their tenders, or of offering for these other engines."

Mr. Gordon gives us six causes for the inefficiency of so many new steamers as appears in the face of the Parliamentary returns, viz.:

"1st. The novel principle of construction of engines thought necessary for accommodating them to the limited engine-room. 2nd. The attempt to have light engines in ships which must afterwards have ballast to keep them upright. 3rd. Defects in the material and workmanship. 4th. Incompetency of ships' engineers appointed by the Admiralty. 5th. 'Quarter-deck' interference. 6th. Some unavoidable disaster. I believe that all of these may be causes of mischief, but the sixth cause suggested does not seem to have effected the evils so glaringly apparent on the Parliamentary returns. The first two suggested causes are discussed above. The third appears also to have some application. But for any one to attempt to account for such heavy repairs and loss of service by the fourth and fifth, and to lay the blame on engineers afloat and officers in command, would only show a bad selection of the one, and an inexcusable interference of the other."

We perfectly agree with Mr. Gordon as to the necessity of a higher rating for engineers in the Navy, with so many engineering offices connected with that department, and the demand for engineering talent which exists there, we think it is absolutely necessary that proper measures should be taken to secure the services of the educated members of the profession. The rating of another class of scientific officers in the navy could not but fail to promote that high standing which the navy is taking as an educated profession, while the many subsidiary advantages which would accrue from having the services of engineers available requires no comment.

As to that subject upon which so much reluctance has hitherto been exhibited, a return of the consumption of coals, no difficulties it seems to us stand in the way. It can surely be told how many tons of coals are put on board a government vessel, and the description of them, at any rate we cannot see why returns given by the officers of the private Atlantic steamers cannot be given by those of government vessels. As Mr. Gordon observes, a difference of one pound of coal per horse power per hour would make a difference to the country of £10,000 a year. We think an annual return should be made imperative.

We have the returns of duty of Cornish engines, and accurate returns of the consumption of railway engines, and we know the economy which has resulted from the experience thus afforded. Annual returns should be published, which would operate as a check upon the coal owner and upon the engineer; and we do not see why a system of premiums for economy in the consumption of coals should not be introduced among marine engineers as it has already worked with good effect upon the Belgian railways and some of the English.

As we have already observed, before we can come to the same conclusion as Mr. Gordon, we must have more extended returns, and more accurate information. It is not fair to the parties to judge them by what is now before us, and as Mr. Gordon appears to have had something to do with obtaining the present returns, we hope in the next session he will take care to prevail upon Captain Gore, or some other member, to move for the extended information we have now required.

Account of the Museum of Economic Geology. By T. SOPWITH, F.G.S. London: John Murray, 1843.

The institution of this museum is an event which cannot but be considered as most valuable to the engineer. It is a recognition by the government of the great advancement of engineering science, and of the influence which it has had in systematically developing the resources of the country. The labours of the engineer have opened up districts not before available, and the development of the means of communication have now given the public an interest in every locality. Under such circumstances a knowledge of our mineral treasures, and of their useful applications, is indispensable, and the establishment of a museum was the most fitting means for effecting this. The establishment formed at Craig's Court, Charing Cross, con-

sequently merits the visit of the student and professional man; and the descriptive account of Mr. Sopwith is one of the best guides he can have on the occasion. Mr. Sopwith has devoted much attention to this subject, and his shilling manual is a most readable and instructive book. The Museum is open to the public gratuitously every day, excepting Sunday, from 10 o'clock till 4, from November to February, and until 5 o'clock during the rest of the year.

"The Museum of Economic Geology, as now arranged, comprises an entrance hall or lobby, an apartment on the ground floor 46 feet long, and 18½ feet wide, and a gallery on the first floor 103 feet long, varying in width from 17 to 25 feet. The department of the Office of Mining Records comprises a Record Office 26 feet by 25 feet, in which are tables for drawing plans, and a gallery on the second floor 103 feet long, containing mining implements, and models of mines and mineral districts, and of various engines, machines, &c., used for working and draining mines. In addition to these are a laboratory, conducted Mr. Richard Phillips, F.R.S., the curator of the museum; a workshop in which models are constructed, under the immediate direction of Mr. Jordan; and a small library or private room for the use of the director. To these apartments additions will doubtless be made from time to time commensurate with the national usefulness of the establishment, and the more so, as, owing to the extensive opportunities afforded by ordnance geological surveys, and the great liberality of numerous owners of mineral property, and other public-spirited friends of science, a large proportion of the valuable contents of this museum have been, and will assuredly continue to be, received without any expense beyond the mere carriage of the specimens. It is gratifying also to know that the present administration cordially approve and support the arrangements of this museum, which was commenced by their predecessors, and by their attention to its interest, evince their regard for those foundations of our national wealth, a knowledge of which, as Sir John Sinclair has justly said, is of more importance to this country than all the mines of Mexico and Peru."

Launch of the Great Britain.

Mr. Davis has got up a lithograph on this subject from the able pencil of Mr. Thomas Allom, which possesses merits not only of artistic treatment, but of accurate delineation. The view was taken immediately after the launch, and the fidelity of it is evident, as also in the case of the adjacent scenery and minor details. It is certainly one of the best representations of the *Great Britain* which has yet appeared; and equally an ornament to the office as to the drawing-room. We extract the following account of the details of the vessel and engines, which are appended to the engraving, and we understand are authentic.

Keel laid Dec. 19, 1839; floated July 19, 1843.	feet	in.
Length extreme, from figure-head to tailrail	322	0
Do. on upper and forecastle decks	308	0
Do. between perpendiculars	286	0
Extreme breadth	50	6
Depth at midships	32	6

She is divided into four compartments by means of iron bulkheads, ¼ in thick, viz., 1st, forecastle; 2nd, fore saloon; 3d, boiler and engine-room; 4th, after saloons.

		ft.	in.		ft.	in.		ft.	in.
Promenade saloon forward ..	length	67	0	width	21	9	height	7	9
Do. do. aft	„	110	0	„	22	0	„	8	0
Dining saloon forward	„	61	0	„	21	9	„	7	9
Do. do. aft	„	98	6	„	30	0	„	8	3

26 state bedrooms with one bed, and 113 with two beds.
Tonnage, builder's measurement, 3,116 tons.
Draught of water when loaded, 16 feet.
Do. without cargo, 12 feet.
Do. without engines, 9 feet.
Displacement of water when drawing 16 feet, 2970 tons.

ENGINES AND BOILERS.

Nominal power, 1,000 horses.
4 cylinders 6 feet stroke, diameter 88 inches.
Slide valves, diameter, 20 inches.
Air-pumps (2), 54 inches.
Steam pipes, 18 inches.
Condensers (2) formed of wrought iron plates ⅜ in. thick, 12 feet long, 8 feet wide, 5 feet deep, and contents 510 cubic feet.
Bed plates for cylinders (2), length, 27 feet.
Do. do. weight, each, 16 tons.
Main shaft wrought iron, length, 15 feet 9 inches.
Do. at centre, for driving wheel, 2 feet 3 inches.
Do. for eccentric bearing and cranks, 2 feet 1 inch.
Do. weight in rough from the forge, near 17 tons.
Framing to carry same is of hard wood, 12 in. thick, cased with wrought iron plates, ½ inch thick.
Boilers having 24 fires, 12 fore and 12 aft, each 6 feet by 2 feet—length, 34 feet, width 32 feet, height 21 feet 6 inches.
Total surface of fire bar, 288 feet super
Chimney 8 feet diameter, height 34 feet.
Screw propeller, 16 feet 6 inches diameter.

EFFECTS OF LIGHTNING AT SEA.

A paper from the commander of the *Vigie*, with an account of the effects of electricity in a recent voyage, was read at one of the recent meetings of the Academy of Sciences. It states that the mainmast was three times struck with the electric fluid very severely, but that no damage was occasioned to the vessel, in consequence of its being provided with paratonnerres. A sailor was sent up to see what effect the electric fluid had on the paratonnerre, and as soon as he reached it, he experienced such shocks as nearly caused him to fall down, and he felt the same every time he placed his hand on the base of the paratonnerre. It had become a magnet. The same effect had been produced on every piece of iron in the vessel. The compasses too had their needles disarranged, and would no longer serve to guide the ship. Eight or ten days after, the *Vigie* met another vessel, and obtained one of her compasses, but the magnetic action communicated itself to this one, and the instrument became useless.

THE NEW HOUSES OF PARLIAMENT.

SECOND REPORT OF THE COMMISSIONERS ON THE FINE ARTS.

To the Queen's Most Excellent Majesty.

We, the Commissioners, appointed by your Majesty for the purpose of inquiring whether advantage might not be taken of the rebuilding of your Majesty's Palace at Westminster, wherein your Majesty's Parliament is wont to assemble, for the purpose of promoting and encouraging the fine arts in your Majesty's united kingdom, and in what manner an object of so much importance might be most effectually promoted, humbly report to your Majesty, that having, in furtherance of the objects proposed by us in our first report, and sanctioned by your Majesty, invited a competion in cartoons, we have now humbly to state to your Majesty that the competition referred to has taken place, and that we are satisfied with the evidence of ability afforded, not only by the works of the successful candidates, but those of many others.

Having satisfied ourselves respecting the attainments of many British artists in the practice of cartoon-drawing, and respecting their capacity to attain excellence in those qualities which are essential in historical painting, we now propose, in pursuance of the plan before announced by us, to invite artists to exhibit specimens in fresco-painting of a moderate size, which, by being portable, will enable all candidates for employment in that method of painting to send in works exhibiting their qualifications therein as painters and colourists, and which, taken together with the larger compositions in drawing which they have exhibited or may exhibit, and with other existing evidences of their talents, may enable us to proceed to the selection of artists for the decoration in fresco of certain portions of the Palace. Nevertheless, as paintings executed in other methods may be free from a shining surface, and may therefore be deemed by some artists to be fit for the decoration of walls, we have invited such artists to exhibit specimens of the methods in question, and shall regard such methods as open for consideration.

With respect to sculpture, we have announced that various statues will be required for the decoration of the Palace, and we have invited artists to exhibit models, in order to assist us in the selection of sculptors to be employed.

With regard to decorative art of various kinds—namely, glass-staining, arabesque-painting, wood-carving, ornamental metal-work, and ornamental pavements, we have, in like manner, issued notices inviting artists and others to send in specimens, in order to assist us in the selection of persons to be employed.

We have further humbly to state to your Majesty, that the claims of candidates for employment in oil painting, and other departments of the art besides historical painting, will be considered hereafter, and that the order in which the several branches of art and decoration applicable to the embellishment of the Palace have been considered by us, has been, and must continue to be, determined by the time requisite for the preparation of the works, the study required by the artists in modes of execution which are new to them, and by the progress of particular portions of the building.

We humbly subjoin, as an appendix to this report, some papers treating in detail various matters connected with the subject of our inquiry, and explanatory of the proceedings of the commission; and, with respect to the architect's report, have to state that we have taken it into our attentive consideration; but although we have, in consequence, issued various notices calculated to assist us in coming to a final decision thereupon, we are not yet prepared to lay any specific recommendation before your Majesty, both in consequence of the building not being sufficiently advanced, and the result of the inquiries and experiments made and making by and under our direction not being sufficiently ascertained, to justify us in coming to any final conclusion in this respect. And with reference to that part of the architect's reports which relates to local improvements in the neighbourhood of the Palace, we consider that, however deserving of attention the improvements in question may be, they do not come within the inquiry with which we are intrusted.

Albert.	Colborne.
Lyndhurst.	Charles Shaw Lefevre.
Sutherland.	Robert Peel.
Lansdowne.	J. R. G. Graham.
Lincoln.	Robert Harry Inglis.
Aberdeen.	Henry Gally Knight.
J. Russell.	B. Hawes, Jun.
Palmerston.	Samuel Rogers.
Melbourne.	Thomas Wyse.

Whitehall; July 28, 1843.

[Here follows Mr. Barry's Report which we published in the *Journal* last May, page 173.]

Extract from the Report of the Committee on Westminster Hall.

Your committee, to whom was referred the duty of making investigations respecting the ancient state and modes of permanent and temporary decoration of Westminster Hall, and respecting the dates and extent of its architectural alterations, have the honor to report—

That they have examined Westminster Hall with a view to the objects of the inquiry committed to them.

That they have reason to believe that the original hall of King William Rufus occupied the same area as the present building.

That they believe, that whatever portion of the fabric of the Norman hall of the palace of King William Rufus may remain, it is entirely encased and concealed by the walls of the actual structure.

That the walls of the actual structure, as they now appear, with the exception of the surface alterations made in 1806-7, and also the existing roof, were erected in the reign of King Richard II., in the year 1398; the walls being then heightened, and the original rubble of the Norman work being then encased in ashlar, and the buttresses added.

That they have no reason to believe that there were any permanent decorations in the interior of the said hall other than those which now exist.

That the temporary decorations on occasion of state trials, or of coronation banquets, varied with the need and propriety of the service to which the hall was applied.

That in the last year of the reign of King Richard II., the hall appears to have been "hung and sumptuously trimmed," by which phrase your committee understand hangings of tapestry and other temporary decoration; but that there is no reason to believe that there was at any time any decoration of painting of any kind on the walls: though in making this observation it is right to add, that your committee feel that there is in the existing hall sufficient light for the proposed exhibition of cartoons.

That the use of banners and trophies suspended from the roof or rafters of the hall was not earlier than the reign of Queen Anne, and was soon discontinued. And in respect to the last subject of inquiry remitted to them, so far as the same has not by anticipation been already answered by the statement that the hall is substantially unaltered, your committee find, that in 1821, the two courts of justice which were excrescences on the south side, and which were comparatively modern erections, were removed; that a door in the centre of the south end was opened; that two smaller doors at the sides were closed; that a row of dormer windows was opened in the roof on each side, and certain doors opened to the courts of law on the west side.

Your committe observe that one of the windows on the east side has been partially closed, two windows adjoining the same having been originally closed externally, so far as it appears by the clock tower of the ancient palace rising directly against them, and still obstructing them, though it was reduced in height by the late Mr. Wyatt in the course of the works which he conducted in 1806-7.

Robert Harry Inglis.
Henry Gally Knight.
Henry Hallam.
George Vivian.

Whitehall, March 24, 1843.

PAYNE'S WOOD PATENT.

In the House of Commons on Wednesday, August 16, Mr. Barclay put a question to the noble lord at the head of the Woods and Forests, respecting Mr. Payne's patent process for preserving timber from dry rot, and the ravages of insects. He understood that the properties of the patent to this extent had been pretty fully tested, and more than all by the department over which his lordship presides, and that it had been satisfactorily shown that it had the property of rendering wood prepared by it uninflammable, or at any rate of depriving it of a large degree of combustibility. Lord Lincoln said he felt most happy to give the honourable member the fullest information he possessed on the subject. The matter had been brought before him in his official capacity, and he had thought it right to take considerable pains to be well informed on so important an invention. He had paid a visit to the premises, and inspected the very ingenious machinery and process of Mr. Payne, but not liking to trust his own judgment in a matter where great professional skill was essential, he had directed Mr. Phillips, professor of economic geology, to examine into the invention and report upon it. That report the noble lord said was highly favourable; and since then he had directed the erection of a structure in his department in which the process had been applied to all the timbers, and under the inspection of the woods and forests surveyors. He had no doubt himself of the great value of the invention, and believed that experience would confirm his present favourable opinion, but time would be necessary to test it. The Admiralty had applied to him on the same subject, and a similar answer had been returned to them. He should be happy to lay before the hon. member for Sunderland the report of Mr. Phillips. Mr. Barclay thanked the noble lord for his satisfactory statement, and moved that the report be laid upon the table of the house, which was agreed to.

A STEAM METER.

M. Clement has invented an instrument which he calls a *manometric thermometer*, for measuring the temperature and tension of steam in boilers of high and low pressure, and particularly to prevent accidents by explosion. It is formed of two strips, one of which is silver, and the other of platina, rolled up in a spiral form. These strips are soldered together, and one of the extremities is fixed, while the other is attached to a copper vertical rod. Owing to the difference in the dilation of platina and silver, when the temperature of the instrument varies, its upper extremity imparts a movement of rotation to the copper rod, which is communicated by means of a rack-wheel to two hands, which indicate the variation of temperature.

The Amicable Assurance Office, Fleet Street.—Tenders delivered August 16, 1843. S. Beazley, Esq., Architect.

Stone from	Portland.	Norfal.
Messrs. Webb	£10,752	£11,000
Mr. Dixon	10 700	10,995
Mr. Herbert	10 640	10,815
Messrs. Cubitt	10,610	10,860
" Soward and Son	10,590	10 850
" Grissell and Peto..	10 506	10,746
" Lee	10 280	10,400
" Woolcot and Son	10 178	10,478
Mr. Winsland	9,800	9,887
Messrs. Piper and Son	9,754	9,954

The Directors have decided to have Norfal stone, and accept Mr. Winsland's tender. The works have commenced.

Public Works in Paris.—The *National* observes, that it is not without interest to consider the sums expended within the last 24 years in the improvement and embellishment of Paris, which have rendered it one of the finest cities in the world.

	Francs.
Expended on works relative to the distribution of water, aqueducts, reservoirs, fountains	30,986,347
In flagging and paving	17,644,061
In purchases for enlarging the public avenues ..	30,047,708
The construction of commercial edifices as well as in objects of art and decoration	62,984,919
In the purchase of ground necessary for those edifices..	17,802,729
Total	168,465,764

REMARKS ON THE PRESENT STATE OF ARCHITECTURAL TASTE AND PRACTICE IN OUR LARGE TOWNS.

(From the North of England Magazine, June 1843.)

I.—General Principles of Architecture.

The state of architectural taste in this country is confessedly very low and imperfect, and does not receive that degree of attention and regard which from its nature and importance it deserves. As the subject of taste does not touch our personal comforts and wants, it is apt to be regarded with indifference, by many, who have means and opportunities of encouraging the art and influencing its practice. It would not be right to say that the majority of such individuals disregard this subject from the direction of their habits and tastes lying altogether, or chiefly, in personal gratification; but, I believe, there are many individuals who, having made it the business of their lives to acquire wealth, and, from association and circumstances, been led to regard material comforts and ease as the chief end of their every-day life, have had no favourable opportunity or stimulus to the cultivation of those refinements of sense and feeling, which embody themselves in the productions of the fine arts. It is true mental endowments are possessed and cultivated in a very high degree by people of all classes, and the present age is immensely superior to any previous one, if not in the profundity, at least in the variety and almost universal diffusion of its scientific acquirements; but this eminence is almost entirely intellectual: it evinces little refinement of taste or feeling, or lively perception of the beautiful.

I do not intend the above remarks to apply, by any means, universally: but they apply, I think, equally to all classes. The middle and lower classes have not the opportunities which are possessed by the upper, of testifying their taste in architecture, but as far as I am able to judge, the latter do not evince that superiority, which from their position might have been expected. There are indeed many distinguished exceptions. There are many who have a very high appreciation of excellence in this art, but still that the censure deservedly applies to us generally, cannot, I think, be denied. Without attempting to account for this state of taste, I merely remark that the effect is in some degree aided, in manufacturing towns at least, by the fact of the mind becoming habituated to the contemplation of works of mere utility in the shape of mills, warehouses, &c., and that the principles which determine their character are unconsciously, but very improperly, applied to works of a totally different nature.

The art, as well as the literature of the present day, is too much a subject of fashion and caprice, and depends too much on the particular taste of the public which may happen to predominate at the time; this remark applies especially to architecture. It may, perhaps, be said that such has been the case in the best ages of antiquity, but it will be found on examination, that the changes which were always going on in style, among the Greeks for example, took place when the art was advancing towards perfection, and were the result of a deep study of its principles and capabilities, and of the variations which are always going on in the manners and customs of a partially civilized people. Our architecture, on the contrary, wants character, and application to the circumstances of the times. A building ought to grow without effort and almost unconsciously out of the wants which call it forth, and should be the result of these, produced under the direction of taste. It is this which makes the remains now existing in Greece, Egypt, &c., so interesting and valuable, as monuments of the past history of those nations; and it is only by working on these principles that we can give our buildings either character or interest.

We must go back to first principles, and apply them to our wants and circumstances. Such is our want of character, that if half-a-dozen of the principal public buildings, which have been erected in this country within the last half century, should be examined a thousand years hence, without accompanying history or tradition, it would be a more puzzling question than has ever yet been proposed to the antiquary, to determine the character, civil or religious, of the people who could raise monuments so various and anomalous. Fortunately the doubt is as to their surviving one century instead of ten. In addition to this prevailing ignorance and indifference to architectural excellence, the architecture of the present day is subjected to the pernicious influence of what is called by some economy, but which is often more akin to meanness. It has been said by an eminent living architect, "Economy is the bane of architecture;" but it is only false economy that architecture has to dread; and I cannot but think that true economy, properly directed, would exercise a very beneficial influence on works of architecture. How often do we see individuals and committees, in attempting to avoid the charge of economy, falsely so called, and to acquire a reputation for liberality and taste, actually commit a much more egregious error than the one they seek to avoid. The result in such cases is often little better than ostentation and a paltry regard for appearances; the works are sure to be all outside, and what little enrichment they do possess, is invariably in the most conspicuous places, to catch the eye of every casual observer. A glance is sufficient to show all the beauty or interest they possess, and when once seen, little desire is felt for a second inspection. How few of our modern buildings offer any temptation to explore and examine their beauties. What have we to compare with our old cathedrals, abbeys, or even small country churches, where almost every visit reveals some new beauty, or tends to deepen the impression of former ones, and this, independent of all interest arising from association?

The ignorance from which all these evils spring, is unfortunately not confined to the public generally, who cannot be expected to possess any profound knowledge on the subject, but is very prevalent among even professional men. It is much to be wished that some standard of proficiency were established, by which the competence of all desiring to enter the profession might be tested; for it is notorious, that comparatively few of those practising as architects, in some of even our most important towns, are really competent by talent or education, to do credit either to themselves or to the profession. That this opinion is founded on jealousy or ill will, I think no one, who looks round on the different buildings in the neighbourhood of Manchester or Liverpool for instance, will assert. With few exceptions, all the buildings in those towns which display real taste, or evince originality of conception, are by non-resident architects; but it would be invidious to remark further, than merely to mention the fact, as regards these localities. Happily this wide-spread ignorance is now beginning to disappear before an increasing zeal for the cultivation of the art, and investigation of its principles, and it may very safely be prophesied, that the more it is studied and understood, the more will its claim to a high place in our regard be acknowledged.

I do not consider it necessary to say anything in defence of the fine arts in general, or of architecture in particular. The time is gone by for its being looked upon as an art merely of utility; and there are few now who will venture to deny its beneficial tendency to elevate the mind to the perception of refined and intense pleasure. I may remark, however, that if taste be important and worthy of cultivation in the fine arts generally, it is particularly so as regards architecture, as the productions of this art are costly, and their influence, whether beneficial or otherwise, lasting as themselves. Besides, buildings of some sort or other cannot be dispensed with, and, being open to the view of all, must have a very extensive influence on the public taste.

I propose first to lay down, and explain as familiarly as I can, some of the chief fundamental principles of the art, including nothing but what may be called the postulates, or self-evident truths, which are really very few and simple, and on which it will be my endeavour to found all the subsequent remarks I may have to make. The chief difficulty in the way of the free reception of the truth of these principles, and the propriety of their application, to our every-day circumstances, is that of divesting the mind of prejudice, or that effect of long habit in viewing objects of a particular character as perfect, or least without at the time feeling conscious of their defects. Almost the whole of architectural rule may be comprized in one idea, which applies equally as a test of excellence in all the arts, viz., *Fitness or Propriety*. It is unnecessary to adduce any proof or even illustration of this, as it would obviously be useless to argue with one who would deny that a thing is good or excellent, in proportion as it serves the purpose for which it was intended, without redundancy or deficiency, and as it accords with propriety of feeling and character. This principle applied to works of architecture, ought to enable a competent and unprejudiced mind, on viewing a building, to ascertain at once, or at least to form a tolerable conjecture, as to its purpose and destination.

This fundamental principle may be considered under three heads, viz.:—1st, *Convenience*; 2nd, *Construction*; and 3rd, *Character*, including Form and Enrichment. All these departments are of course modified and controlled by economy, and also combine with and control one another.

We shall consider first, *Convenience*, which will determine the number, size, and arrangement of the different portions of the edifice, according to their use and purpose. These considerations are so various and extensive, that it would be both tedious and out of place to enter into an examination of them now. I may, perhaps, at a future time notice some few instances in which our practice is defective. When this distribution, depending on convenience, is determined, the next subject demanding attention, and which is, perhaps, the least regarded, is *Construction*. This includes considerations of material, climate, and durability. As to material, that is obviously the most proper to be used, which possesses in the highest degree the requisite strength, durability, and resistance to climate. There are three classes of materials commonly used in buildings.—1st, those which are best adapted to resist compression, as brick, stone, &c.; 2nd, those best adapted to resist cross strain, as wood; and 3rd, those which resist tension, as iron. Now, it is important to remark, that from the totally different qualities of these three classes of materials, they require in construction, a totally different mode of treatment! thus, the first class are obviously best suited for external and internal walls, those parts of the fabric in short, on which all the rest must depend; the second class are best adapted for horizontal and oblique bearings, as in floors and roofs, and the third are calculated for ties, and for various other minor purposes. Of course, there are peculiar circumstances in which the application of these materials may vary, but the above are the general and obvious uses to which they are best applied. The climate also exercises (or I should say *ought* to exercise, for in this country it does not) a very considerable influence, not only on the material employed in building, but also on the forms and features, as pitch of roofs, &c.

Now these general principles, simple and obvious as they may seem, and indeed are, are very often disregarded in practice, which is one cause of so much incongruity and want of character in our architecture. I may also mention now, in connexion with propriety, another very important fundamental principle, forcibly expressed by Pugin in his "True Principles of Christian Architecture," and a disregard of which is a chief source of error in this country. I mean that "the construction of a building should avow itself;" there should never be any attempt to conceal the real structure, by a sham apparent one. This every unprejudiced mind will allow; it is, in fact, only a consequence of our first rule of fitness. The mind must be satisfied on this point before it can derive pleasure through the senses: for let an object be ever so beautiful in form and enrichment, if there be any misapplication of materials, or any attempt at deception; if it betray any mean device or contrivance by which it is made to assume (in material or otherwise) a character not properly belonging to it, a refined taste can never but be disgusted with the deceit; while all the beauty which may belong to the mere form tends only to increase the feeling of dissatisfaction which such an object would excite. In addition to what Pugin has said regarding the concealment of construction, I should say that, as a general rule, we should not only not take pains to conceal it, but that we should also, as far as practicable, expose the real construction to view. Every essential part of the structure should be apparent. Another rule which follows from the above is, that every object in art should be in form, colour, and dimension, just what would be in accordance with the nature of the material of which it consists. It was on these fundamental principles that the magnificent works of the Greeks and Egyptians were executed, and also those wonderful structures of the middle ages, which adorn every quarter of our island.

The rules above given are constantly violated in the present day. We see in all parts of the country, but especially in the neighbourhood of manufacturing towns, hundreds of houses which every body knows to be built of brick, but which from some fancy or other, are made to appear as though they were built of stone, betraying at once, the pride of the proprietor in desiring an expensive material, and his poverty in being unable to obtain it. The practice is so universal, that many, I have no doubt, do not see the matter in this light; and many follow the custom, because it is come to be considered necessary for maintaining a respectable appearance; but I believe that pride originated it, and that when it is analyzed, it will come to what I have stated. Another instance in which plaster is improperly made to assume the appearance of stone, is very frequent in churches, entrance halls, &c.; it consists in lining it in imitation of large square stones. Now this being a deception is sufficient at once to condemn it, but it also has a very chilling and comfortless effect, and the practice ought to be abandoned. If I recollect rightly, Pugin has in the new catholic chapel at Birmingham, left the surface of the plaster quite plain and rough, a practice certainly not to be recommended. But he may, perhaps, look forward to its being ornamented at some future time, when means will allow. I am quite willing to admit the propriety of plastering interior walls, and also the desirableness of relieving the monotony of a plain flat surface, but there are other and more legitimate means than the one just noticed, of doing this, which may be used according to circumstances. For churches or chapels, where there is a great breadth of bare wall, the best way, as well as the most obvious, would be to impress the plaster while soft with an appropriate device in the way of seal or stamp, which would at any rate be consistent with the nature of the material, and would afford ample scope for ingenuity and beauty at comparatively small cost. The other methods of avoiding monotonous surfaces of plaster are in common use, viz.—painting and papering, and are perfectly legitimate when applied consistently. But we frequently see walls and ceilings painted in imitation of panelling, or of some other material, as marble and costly woods, all which are bad, because they are attempts at deception, and for the same reason, paper hangings which exhibit natural objects, raised apparently from the surface of the wall, whether in colours, or mere light and shade, are improper. The ornamental pattern on the paper may be as simple or as rich and complex as the character of the apartment requires, but to be in correct taste, it is essential it should appear as a flat surface. Imitation of woods, marbles, &c. in plaster, either by painting or otherwise, are just as bad as imitations of stone by plaster on the outside of a house; for though the finer woods and marbles may possess more beauty than commoner materials, the chief motive for imitating them is the desire of displaying costliness without incurring cost. If these remarks are well founded, I think the use of scagliola cannot be justified on the strict principles of taste. Even the plainest materials are more satisfactory than the most beautiful imitation of the costliest woods that ever were seen; indeed the more costly the material imitated, the more unsatisfactory the result, as the probability of its being sham is increased in proportion.

But to return to the consideration of brick and stone. Brick is best adapted for plain walls, because if well burnt, it is more durable than stone, more impervious to weather, and in many places is much cheaper. Both propriety and economy, therefore, point to it as the most proper material for general use, in such localities. But on the other hand, brick cannot be used where cutting is required, here its place can only be supplied by stone; but there is a very simple method of ornamenting brick buildings, which seems to be almost unknown or forgotten amongst us, viz., by moulding the bricks into different forms and ornamental devices, and by using bricks of different colours, as red, blue, and white. In this way a true artist would be able to produce many beautiful and picturesque effects; bands or string courses might be thus formed either by impressed patterns, or by a different coloured brick; chimnies might also be made highly ornamental, all which would be in perfect propriety, and might be obtained at a trifling cost, without the use of stone at all. However, the judicious use of stone in combination with brick, as round the windows, doors, &c., and in cornices, gives rise to many striking effects which could not be obtained with brick alone. This mixture of materials is most properly employed in ordinary dwelling-houses, or where very little carving is required; but where this is abundant and elaborate, as in a church, the use of brick should perhaps be discarded altogether, as it would form too small a proportion of the wall to justify its introduction, on the score either of durability or economy. This was no doubt one reason amongst others, why the churches of the middle ages were almost invariably built of stone; but it cannot be urged as a reason for employing this as a sole material for ordinary dwelling houses. Here, good taste requires that economy be consulted, and economy will, in many parts of the country at least, point to brick as the most proper material. But for sacred edifices the case is quite different. In these, economy is hardly excusable except in extraordinary instances; and as stone is undoubtedly the most dignified material, great exertion ought to be made to secure it.

As for timber and plaster buildings, I do not think there is much probability of their becoming general, though instances do now and then occur of houses, not indeed of timber, but of brick, painted to imitate the old style of timber house. This is actually worse than imitating stone in plaster, because it is disguising a good and honest material in the garb of one decidedly inferior. Must we then give up for ever all imitation of those beautiful and picturesque examples of this style, once so ornamental to our ancient cities? We must: no circumstances can now arise, which can give any occasion, or call, for such a mode of construction. Ancient remains are, no doubt, very picturesque and beautiful, and their beauty is of a kind too which cannot be transferred to any other material. But the old builders did not employ wood in the construction of their houses, for the sake of the beauty or effect they could thereby impart to them; the timber was employed for convenience and economy, and its accompanying beauties were superadded, and were the result of the taste and feeling of the builders. And as we must discard the use of wood for such purposes, we must also be content to forego its accompanying and characteristic beauties, and employ our taste and ingenuity and love for the beautiful, as they did, on the materials best adapted, by convenience and economy, for our wants.

The legitimate use of timber in construction forms the next subject for consideration. The nature of this material points so obviously to its proper application, that it would be difficult to go very far wrong. But I must take this opportunity of noticing the universal practice of concealing it from view. What reason can there be for thus hiding a most essential part of our architecture? It is only another result of the blind admiration of the classical styles which has now prevailed so long. What I complain of is the use of plaster ceilings to conceal the construction of floors and roofs. "What," says a writer, in the *British Critic*, "is the theoretical notion of a flat plaster ceiling?" What portion of the construction does it represent? It more nearly resembles "a vast marble slab" than anything else substantial. This absence of reality gives to a room an appearance and effect of incompleteness, and consequently of discomfort. In spite of habit, I am frequently tempted, when looking up at a flat plaster ceiling, to ask myself whether it is really safe, for it seems to be suspended in mid air above one's head with nothing apparent to sustain it, and this effect is not improved, though the monotony may be relieved, by panelling, coving, or any other device. Now, of all the portions of an apartment, the covering ought from its position, to have an effect of security, and that effect should be at a glance apparent; we should not have time to ask the question, before being satisfied on this point. Though people in general see nothing amiss with a flat clean white ceiling, this arises altogether from habit, and I am persuaded that were a person to accustom himself to compare ceilings as they are, with what they might be made, if the timbers above were shown and appropriately carved and decorated, he would very soon think as I do. Ceilings in churches are now happily going out of favour; but as to dwelling houses, I see no prospect of even a commencement of reform in this respect; and I dare say the very idea of exposing the floor joists to view will be absolutely ridiculed by many; nevertheless, I am quite satisfied that were we once to get over the novelty, the change would add greatly to the appearance of security and completeness in our apartments. I might add more on this head, but shall reserve further remarks to a future opportunity. I merely mention the practice now, as an example of the violation of the fundamental rule, that the construction of a building should not be concealed from view.

In treating of construction, I cannot omit saying a few words regarding the use of cast iron, which at the present day is so very extensively used in building. Had we gone on right principles, this material would very likely have modified considerably the character of our architecture, (for, in all ancient and independent styles, the nature of the materials employed has modified their character more than any other cause) instead of which we keep on in the same track of columns, pilasters, architraves, &c., attempting to emulate and imitate the style of a distant age and country, with totally different wants and climate; while with a false shame we attempt to conceal our own real constructive resources; from which, under proper direction, we might rear a national style, in accordance with our national character and civilization. At the same time, I confess that the question, how far and in what manner cast iron may consistently be used in constructive architecture, is not easily solved. But we may safely lay it down as a rule, that its use must be in accordance with our fundamental rule of fitness and propriety: and therefore that it cannot properly be used where, if it is seen at all, it cannot assume the character and appearance belonging to the material itself. We frequently see portions of stone buildings which are most exposed to injury from being chipped and broken, as base courses, plinths, balustrades, &c.,[1] constructed of iron, and painted to resemble stone; under the false notion that the beauty of the parts will remain with, and depend upon, the sharpness of their preservation. Now, even supposing that the beauty of stone work did depend (which I by no means grant) on its perfect preservation, I contend that such contrivances are bad in principle, are never satisfactory even when quite new; and in a very short time the parts become so rubbed and polished, as to lose what little character of stone they at first possessed; and their very sharpness becomes a defect. I would far rather see genuine honest stone, even if it were a little chipped: indeed, I do not think a little damage of this sort here and there, in exposed situations where it is only to be expected, at all detracts from the beauty of stone work where there is any. To come at once to the point—I believe that for ordinary building purposes, in the styles usually adopted in this country, iron cannot be considered a proper material. We may perhaps, at some future time, have ingenuity enough to give it an appropriate and characteristic appearance, and then it may be properly brought into general use.

It must, however, be understood, that the above remarks do not apply to iron when used in fire-proof buildings. Here a new element is introduced, and the style and material have to be modified accordingly. Now, as in this class of buildings wood cannot be introduced, iron comes to our aid most opportunely, and may be used without reserve as a substitute for wood. It may indeed be considered a most valuable and indispensable material for such purposes. It should, however, in all cases assume a characteristic form. With the above important exception, the chief value of iron is in engineering and machinery, not in architecture.

We come now to the consideration of character, including form and enrichment. One of the chief causes of all the bad architecture of the present day, is a want of propriety and consistency between the outside and the inside of a building. The proper method of designing, and that which was followed by the architects of the middle ages, is, first to get a good and convenient plan, and on that to raise an exterior possessing the appropriate qualities of beauty or grandeur, most consistent with its purpose. Our system is, I might say almost universally, the direct contrary to this; we either design the exterior first, and adapt the plan to that, or we arrange the plan or interior with reference to some imagined exterior; and in either case we very often spoil both inside and out. We put up with inconvenience in the plan, for the sake of effect in the elevations and we so study and constrain the latter, that, whether in a symmetrical style or not, they seldom possess the expected beauty or charm, even if they possess any beauty at all.

This is one of the evil consequences of copying the style of a distant age and country, and disregarding our own peculiar climate and manners, and the architecture which arose out of them. Our climate requires high-pitched roofs to throw off the water; we must have chimneys for the escape of smoke, numerous and spacious windows, variety in the parts and purposes of our buildings; all which are utterly at variance with the classical styles. On the other hand, we have no occasion for columns, entablatures, open porticos, and colonnades, which are absolutely necessary to the classical styles. Our requirements and wants are all internal; Grecian architecture is all external. Hence it follows, that classical architecture is not fitted for this country; and our surprise at its being so persisted in is the greater, from the numberless examples still remaining, of a style actually the birth and produce of our own soil. What can be more absurd, than building private mansions after the manner of Roman palaces, and Christian churches in the likeness of Greek temples. Some indeed seem to consider that we have at length had enough of such imitations, and to think that, for the sake of

[1] The whole surface of the ground floor of a pile of warehouses I have lately noticed to be faced with iron plates. If, in the construction of these warehouses, convenience, and convenience only, had been consulted, instead of grandeur of style, we should have had, instead of a mock imitation of a palace, a plain, honest, substantial, brick and stone warehouse, suited to its purpose, and telling its own tale. The doors and windows would have been in effect widened, by splaying their jambs, instead of being constructed and made perfectly square for the sake of effect; the sharp angle involving the supposed necessity of using a false material.

relief, we had better try what we can do with other styles; and we accordingly now import from Italy, Switzerland, Egypt; and we shall no doubt very soon have specimens after the Chinese fashion. But, as we cannot import with them the peculiar climates to which they belong, nor the peculiar manners which created them, we detach them from that which gives them character and meaning.

Even when the true national style is chosen, the application of it frequently betrays an utter ignorance of the rules of propriety. The many fine remains of castles and abbeys which adorn our land are no doubt worthy of admiration, but there is just as much propriety in imitating them in our modern dwelling houses, as there would be in a man going about in a monk's habit and cowl, or adopting the manners and defence of the twelfth century. A great deal might be said on this point, but I shall reserve further remark to a future occasion, when I hope to speak of architectural principles as applied to particular classes of buildings.

As regards enrichment, my limited space will not allow me to say so much as I could wish. The grand rule for its regulation, as laid down by Pugin, is, that "we should decorate our construction, instead of constructing our decoration." All the parts or features of a design should be useful first, and then ornamental or plain, as determined by propriety and consistency. No part should be constructed for the sole sake of ornament or effect, or which has not some significance. The essential parts of a fabric should be the only medium for rendering it beautiful. This rule exists, irrespective of any particular style; but in passing, I may mention that it is an additional argument in favour of our own national style. We too often loose sight of propriety and consistency in decoration, which is apt to be regulated more by consideration of expense than any thing else. The almost universal desire is "to have as ornamental a structure as the means will allow." This mania for indiscriminate ornament is chiefly owing to the facility enjoyed at the present day of obtaining it without limit by casting. In ninety-nine buildings out of a hundred, where there is any quantity of ornament, it is sure to consist of casts, either in metal, plaster, cement, artificial stone, compo, paper mache, &c.

In speculation houses, the ceilings and cornices are covered with ornament, (especially if the builder happen to be a plasterer, who has thus a fine opportunity of displaying his taste and his patterns,) and the same character of ornament, if not the same degree, is carried into halls, drawing-rooms, and bed-rooms, and thrust into all sorts of positions where it can be most seen. We see in cottages, and workhouses, grates and fenders literally covered with ornament, and rich enough for a gentleman's drawing-room. But, as it would not do for the same patterns to be used indiscriminately, in the houses of the rich and poor, numerous grotesque and meaningless forms have been devised to increase expense, and thus render the patterns fit for genteel residences. The same principles are acted upon in other materials, as cement capitals to stone columns, composition trusses supporting wooden friezes, all painted in imitation of stone. I do not mean to censure *in toto* the use of cast ornament; but what I insist on is, that it should be used consistently with propriety, and the tendency is, without great caution, to apply without discrimination, ornaments which in this manner can be obtained without a corresponding cost.

I think very false and pernicious notions regarding the value of ornament are commonly entertained. A great part of the charm of ornament consists in the importance it gives to the parts where it is used, and in the evidence it conveys of the high estimation in which such parts were held—of the taste, imagination, and love of beauty in the mind which produced it; and of similar qualities together with masterly execution, in the artificer. Now, when ornament is produced mechanically, and consists merely of plaster or cast iron, all the interest derived from this latter source is utterly lost. It ceases to be any criterion either of the liberality of the owner, or of the taste and talent of the artist. Besides, cast ornaments have never that freedom and boldness of relief which belongs to genuine carving.

In conclusion, while I urge the curtailment of the excessive use of decoration into which we are so apt to run, I would remark that if judiciously and consistently employed, its loss in quantity would be much more than counterbalanced by its gain in value and interest.

Henry Bowman.

Manchester, May 1843.

THE DECORATIONS AT THE TRAVELLERS' CLUB.

(From the Athenæum.)

Extensive decorations, costing, it is said, some thousands of pounds, have recently been completed at this very happy adaptation of the Bufalini Palace. It is a satisfactory sign for the progress of art to find a growing attention paid to architectural decorations, and, in so far as those lately executed at the Travellers' Club are likely to promote that desirable result, we are disposed to welcome them; but, in proportion to their probable influence, it is the more necessary to protest against that absence of all principles, which is manifest throughout—on floors, on walls, on ceilings, in passages, and in rooms. Tasteless and chilling as may be the universal white paint of Queen Anne's days—of which the library at Blenheim affords a cool specimen—monotonous and depressing as are the drab and slate colours patronized by George IV., which abound in Windsor Castle, and are, unhappily, conspicuous in Buckingham House, (the pictures in the long gallery are hung against a drab-coloured wall,) it may be a question whether they are not preferable—exciting, as they do, no interest whatever—to bright colouring so misemployed that the eye cannot turn without detecting some false principle of taste.

The greatest offences in the decorations of the Travellers' Club arise from the employment of affectations and unrealities, which abound everywhere—sham granite walls, sham marbled columns and dados, sham bronze doors, sham bas-reliefs. As soon as you have passed the hall of entrance into the corridor, the fictions begin, and you traverse a passage of universal granites—pink, grey, green, &c. Besides being an affectation itself, this is the affectation of an unfit thing. Suppose the thing for an instant to be all real—would a *granite* passage be right in such a place? We are not entering an Egyptian temple, or the basement of a castle, but the light, cheerful passage of a sort of democratic modern palace, free from all fear of outward violence, and with a portal no more capable of resisting attack than polished mahogany and plate glass. Granite surely is not a material to be used here. But if you *will* use the hardest of stones for such a purpose, then ought not the forms in which you employ it to be somewhat analogous to the material itself? Here you have mock granite adapting itself to Italian mouldings—so light and elegant that you would select the softest oolite out of which to chisel them. The ceiling, too, is painted to affect granite. Do not all analogies drawn from nature, as well as all good architectural precedents, tell us that the upper part of a building should be in all respects of material, form, and colour, lighter than the lower part? Let us forget this affectation of a thing out of place, and look at this passage simply for its colouring, which indeed begets the first general impression. Banish from recollection that the colouring is grained, and look at it as a surface of pink and grey—which is its aspect to most eyes. It may be a right principle to keep the passages and halls duly subordinate to the rooms, in respect of their decorative characteristics, but surely a passage that faces the *north* needs to be a little warmer and more cheerful in colouring than one which looks south. Yet here, in a due north aspect, we have shades of cool colours. The materials employed in the building of this hall, and its ornamental parts, are chiefly wood and plaster, made to be coloured. Would not correct taste, then, simply colour them, producing the best effects out of the unlimited range of colours?

The wainscot staircase of the club remains substantially as it was before these recent decorations. Being chiefly of oak, its very reality protected it from change. The ceiling here has been richly painted in various bright colours, displayed in arabesque forms and panels, generally resembling those we also find in the drawing-room—for which very reason we think that these decorations cannot be altogether consistent—certainly they do not accord with the oak stairs and banisters. The walls here, as in the upper corridor, have been divided into panels by arabesque borders and lines. The effect is light and tasteful; but the carpet, which is a mass of unbroken crimson, is much too full-toned and positive to accord well with the delicate pale hues of the walls. The figures in the arabesque painting do not rise beyond second-rate decorative art, and the human figures which are sometimes introduced, are by no means well drawn or well proportioned. The highest academical excellence in drawing ought not perhaps to be demanded under such circumstances, but in this case, as it was thought necessary to send out of England for a decorative painter, we might fairly have anticipated something better than what we could have produced ourselves. In the present case, the work—both in design and execution—is certainly not beyond the mark of many of the London decorative painters. If our school of design has produced any fruits at all, it must by this time have educated a score of pupils quite up to the standard of these decorations.

Through a mock bronze door—of which a few words presently—we enter the drawing-rooms. What is the first general impression, without examining the details? The tone of the colouring is neither warm nor cold—though parts are of both characters, and there is no lack of many varieties of colour. The aspect of the room is a north one, and being such, the prevailing arrangement of colour should be warm. Modify it as you please to suit the particular character of the apartment—but do not forget that the room receives hardly a ray of direct sunshine throughout the year. In these drawing rooms the greater part of the surface of the walls is of a pale, cool-looking colour, something between a lemon and a cream colour, arranged in panels, which are bordered by strong and rather dark contrasts. The lower part of walls, the dado, and its mouldings, are coloured imitations of marbles, in

which a bluish green predominates. Then the doors and window shutters are coloured dark green, to imitate bronze—a violent contrast to the walls—and made the more positive by the deep crimsoned draperies of the curtains. The ceiling is richly coloured and gilt, whilst the walls are comparatively plain. The character of both ought surely to be more consonant—or, if there were any difference, ought not the more attractive features to be on the walls, where they are most easily seen? Look from the ceiling to the carpet, and in the latter there is the same absence of concordance and propriety. It has no leading key-note of colour—so to speak—but is a sort of helter-skelter of many colours. These rooms cannot be said to have any general effect, or any one strong point to which all others are subordinate. There is nothing positive—nothing consistent—one part is warm, another cold. Richness in the ceilings, poverty on the walls;—deep-toned colours brought into violent contrasts with others of a very low tone. As for harmony and due subordination of parts one with another, they cannot be met with. The whole gives an impression as if it had been the work of a committee, where there had been a compromise to suit every one's taste, and each member had undertaken the independent arrangement of different parts—one superintending the floor, another the ceiling, a third the walls, a fourth the doors and shutters, a fifth the draperies, and so on. Having looked at the rooms thus generally, we proceed to glance at some of the details, which, in their want of principle, deserve severer criticism.

The ornaments are inconsistent with each other. Some are early Grecian, some Pompeian, some of the age of Louis Quatorze! as in the cornices of the window curtains. There is no objection perhaps to a combination of different styles—but it can only be realized successfully by a principle which, depriving each of its distinctive and independent character, succeeds in making all integral and harmonious parts of a novel creation. In architectural forms Palladio and Wren succeeded in accomplishing this, when they took those of ancient Rome and adapted them to the buildings of modern Europe. But the decorations at the Travellers' Club are very wide of the application of such a principle. Each different part—said cornices especially—looks like an independent impertinence, and to have been brought together by chance or caprice. It has been noticed that the doors and window-shutters are painted in imitation of bronze, of a dark-bluish bottle-green hue. The same question suggests itself here as below in the granite corridor. What want could there be even for real bronze under such circumstances? The doors are subjected to no violences; not even exposed to corrosion in the open air. At best, they are unsightly mockeries. On the panels of the doors are painted imitations of bas-relief metal work. Imitations are tolerable in proportion to their successful approximation to realities. When it was decided so to ornament these panels, the use of real metal, iron, if bronze was too costly, would not have been an impossibility: A few shillings' worth of Mr. Bielefeld's *papier maché* ornaments would at least have given an actually raised surface, and insured natural shadows whenever the door was opened. Now under fixed painted shadows, every time the door is opened a positive untruth is told in the face of the light. What can be said of the drawing-room carpet?—a thing in which the cost of pattern is hardly a consideration · certainly not to such a club as this. It is just the carpet you would chance to find adorning the drawing-room of a flourishing cheesemonger in Aldgate or the Minories: flowers of every hue displayed in shaded golden scrolls. It belongs to no recognized style, ancient or modern; even that lowest of styles, the Louis Quatorze, would not own it. Is it not a mistake to attempt any imitations which cannot succeed? If we want the representations of flowers, let them be executed by means which insure something like a correct representation. Employ colours and brushes in the production of pictures et them if you will, but surely not worsted threads. The Greeks took the beautiful forms of nature and used them not as affectations to recall feebly the remembrance of the originals, but adapted them in new methods to new purposes—which suggested new views of their intrinsic beauty. Even the artists of the middle ages exercised a better taste than ourselves. A bunch of flowers or group of animals worked in worsted, with its angular shapes affecting to imitate the flowing lines of nature's original, with its crude colouring and hard-marked blotches meant for brilliant hues and soft graduated shadows, merely reminds you how signally it is unlike what it has copied. How different is the effect produced by the pattern of the Grecian honeysuckle or the acanthus leaf on the Corinthian capital! We look on both as works intrinsically beautiful in themselves, as new creations and not as imitations. The Arabs have taught us how we may have a beautiful arrangement of colours almost independent of pattern. But we do not now intend to write an essay on carpets; and we can only dispatch that of the Travellers' drawing-room by saying that it has both pattern and abundance of colours—but combined on such false principles that the meanest of Grecian ornaments or Arab combinations of colours rise very far above it.

We have thought it worth while to enter somewhat at length into this matter, because the members of the Travellers' Club belong to a class who will probably exercise some influence in those decorations of our national buildings which seem to be likely to be realized at no distant day. Should the parties who are responsible for the taste of the decorations in this club, have any voice in directing those of the Palace of Westminster, we hope our remarks may induce them to reflect that there are principles in such matters, which cannot be neglected. If it be true that some thousands of pounds have been spent on these works, we do not scruple to say that a more satisfactory result might have been produced at a much less cost, had a more correct knowledge of the principles of decoration been applied.

ON SIMPLICITY OF COMPOSITION, ESPECIALLY IN CHURCHES OF THE EARLY-ENGLISH STYLE.

(From the Ecclesiologist.)

One very striking difference between ancient and modern compositions in this style is the characteristic ambition of the latter to attain *effect*, by the introduction of a great deal of showy detail, in positions where it is neither required by use, nor sanctioned by the principles of true architectural propriety, so far as the general practice of antiquity be admitted as the test of correctness in these points. We do not mean that superabundant ornament, properly so called, is the common fault of modern churches, but that genuineness is too often sacrificed for show, and that shallow and poverty-stricken designs are meretriciously tricked out as if for the mere purpose of deception, with inappropriate because unnecessary embellishment, while the really essential elements of strength, utility, and reality, which alone constitute true beauty, are either unaccountably overlooked, or knowingly neglected as matters of secondary importance. For instance, how frequently do we see a thin shell, though internally destitute of piers and arches (features absolutely essential in churches of a certain size), disguised and set off by a ridiculous display of pinnacles, turrets, ornamental parapets, and crocketed canopies, where not one of these would have been thought of by an ancient architect in building a church of the same size and with the same means. He would have disdained to give affected elegance to his bold and low massive walls, his stately roof, and his fearless irregularity of buttress, windows, and gable: much less would he have used cast iron props for piers, that he might have more money to spend in making a fine street elevation.

The fact is that a certain amount of external decoration, or rather *showiness*, is erroneously considered requisite for the correctness of a church, merely because it is necessary to ensure a competition design being chosen. Now it is very important to observe how completely the ancients were influenced by the *contrary* principle. There is an honesty in their designs which is very striking, if we contrast it with the spurious architectural pretension of many modern churches; and we speak more especially with reference to those generally erected three or four years ago, though specimens of this sort are unfortunately common enough at the present day. They never made their walls a foot thinner, or their buttresses a foot shallower, or their roofs lower and less substantial, than they ought to be, that they might expend a larger sum upon a fine doorway, or a superfluous arcade, or a richly decorated front. With them all was real, genuine, and natural. No one part was extravagantly adorned to the disparagement of the rest; if one feature was costly, all was in accordance, and not one half starved that the other might be pampered. In a word, nothing was attempted that could not be well and consistently carried out.

Again, as to the kind of ornament now generally used, much grave objection is to be raised. There is, so to speak, a certain quantity of generally recognised Early-English detail, culled from every possible source, the mighty cathedral, the costly abbey, the larger parochial churches, as well as from books, foreign and English, and the traditional kinds of ornament used, perhaps with no authority at all, by modern builders, all of which is thrown into a common stock, to be freely and indiscriminately applied to any building, without regard to its size, character, situation, or conditions of structure. A few points we will proceed to specify, in which, according to the extent of our own observation, modern designs are not consistent with ancient models.

1. We scarcely ever see a modern early-English church, however small its size and otherwise humble its pretensions, without showy octagonal pinnacles, having heavy cappings and angular shafts around the stem. This feature would almost seem to be considered an absolutely necessary characteristic of a church of this style, and accordingly it is repeated over and over again till the eye is quite wearied of it. Yet who ever saw the like in a real early-English church of the same size? These are essentially cathedral features, and even there are scarcely found, unless of actual use in balancing a vault.

2. Flying buttresses, and buttresses in general, are, we think, greatly misapplied. We scarcely ever see a modern early English buttress without pedimental head and set-off, though these are in fact comparatively rare in ordinary churches of the thirteenth century. A cathedral or a great monastic church will have, of course, much rich and costly adornment in every part; it will have, therefore, elaborate buttresses with lofty triangular heads rising above the parapet for the springing of the flying buttresses which span the ailes and support the clerestory; but where are these found in smaller churches? Here we seldom observe any but bold and plain supports, for use and not for show, and therefore placed exactly where and as they are wanted, and not at all unless they are really wanted, without the least affectation of ornament or regularity, in short without a particle of trickery about them. Examine, for instance, the plain specimens at Barnwell, Cherry-Hinton, or Histon, and imagine what the effect would be were they exchanged for the trim and chamfered, but meagre and regular, buttresses of the modern architect.

3. Gable ornaments. We really have seen very few modern designs without every gable being pierced with a vesica piscis, a foliated triangle, a circle, or some fantastic little window. Architects, until the last year or two, so seldom thought of a good high-pitched roof, that they now seem frightened at their own gables, and very often greatly injure their effect by inserting these unnecessary and not always even appropriate ornaments. We

are satisfied that they are of comparatively rare occurrence in ancient parish churches, and that properly speaking they are adapted only for very large and rich edifices. An example, indeed, occurs in the chancel at Trumpington, and in churches of this date circular gable lights sometimes may be found; we think, more frequently than in early-English.

4. Of western doors and western triplets we need in this place say nothing, having endeavoured in a former number to prove them inadmissible in small churches. In general, we greatly object to the common practice of coupling or tripling lancets in every position, and not less so to making them of the very exaggerated size and disproportionate breadth we frequently find in them. The disposition and just dimensions of lancets in general is a subject requiring the greatest judgment and nicety, and is therefore deserving of the most earnest attention, since there is no detail so generally misused as this. We have constantly seen small modern churches lighted by lancets almost large enough for a cathedral, and admitting as much glare as perpendicular windows. We may instance the new churches of St Michael at Stamford, and St. Andrew at Northampton. What a contrast do such buildings as these present to the sombre and subdued light which was eminently characteristic of all early-English churches!

5. Apses. We have often had occasion to remark upon the impropriety of these in any but Norman parochial churches, and even here we by no means recommend their adoption. We believe that no instance of an early-English apse in a small church occurs in England. Certainly, if any can be found, they are but exceptions. Yet our modern architects generally terminate their churches eastward by a semi-octagonal or a semi-circular apse, perhaps only ten or twelve feet deep. This is a cheap and in some respects showy substitute for a full chancel; but it is not an English feature, nor is it by any means either a becoming or appropriate one, since it is in fact a mere altar recess, and in nine cases out of ten is without an entrance arch. Moreover, as the right position of the altar in an apse is upon the chord of the arc and not against the east wall, the altar is either so placed as to violate the original meaning and use of the apse, or brought prominently forward almost into the nave.

6. Parapets and gable-ends. The first are not necessary in small churches. The eave-roofs of most ancient examples, we think, fell simply and unaffectedly upon the bare walls; whereas an ornamental parapet, with a cornice of notch-heads, or dog-tooth, or corbels, is now usually considered indispensable. We recently inspected a design for the restoration of an early-English church in Lincolnshire, where very insufficient funds were obtained even for absolutely necessary repairs; yet among the "essentials" a "moulded parapet to the chancel," though it did not appear ever to have had one, was prominently set forth. There is no need to be ashamed of a great roof, or to attempt any disguise or superfluous decorative concealment. A parapet will often, by its over-neatness and appearance of affected finish, detract from the bold and picturesque simplicity of a small church. And the lower the roof, the more objectionable a parapet becomes. Modern gables too are generally awkwardly terminated at the eaves by heavy shoulders or prominent saddle-stones, or look somehow as if the architect did not know exactly what to do with them; whereas what he ought to have done with them was simply to let them alone. The ancients seem seldom to have cared much about them, but to have let them fall easily away with a notch-head, or a bead, or a chamfer; or at most with gablets, as at Stapleford: but always plainly, and therefore gracefully and appropriately. The complex gable arrangements we have seen in numerous modern designs are strikingly contrasted with these.

Nothing, in fine, is left to itself, nothing is plain, unpretending, simple, irregular, accidental. Every detail is overdone; we must have nothing but triplets, and arcades, and wheel-windows, and trefoiled ornaments; and we must always improve our towers and east and west elevations by pinnacles and flying buttresses. Thus much is affected, but nothing attained: parts are strained and exaggerated, but general effect is rather injured than improved. For what constitutes effect as applied to ecclesiastical architecture? Appropriateness, solidity, grandeur, honesty, chasteness, boldness; not unnecessary and meretricious ornament, but the position of a feature just where it is wanted and as it is wanted, without disguise, without hesitation. It is not the insertion of a north window merely because there is a south one exactly opposite; not the making one side exactly of the same size and shape as the other; not having buttresses, windows, and doors of precisely the same height and breadth and design in every part of the fabric. Such were certainly not the principles which guided our forefathers in the erection of their churches, and we must endeavour to enter fully into their principles of composition and distribution before we can hope to produce the same effect merely by the use of the same kind of details; a truth which has indeed often been urged, but still has not met with due attention.

It must, nevertheless, be observed that there is a wide and important difference between plainness and meagreness in church architecture. The former is simply the absence of ornamental detail, the latter is a scanty and stinted development of the essential parts of construction. A building may be plain, and yet perfectly graceful and pleasing; but if it be also meagre, it necessarily becomes ugly; as all who have seen Christ church, St. Paul's, and St. Andrew's, in this town, will readily acknowledge. For in the one case we perceive at once that all, as far as it goes, is genuine and complete, and therefore pleasing and satisfactory to the eye. In the other, the affectation without the attainment of the primary characteristics of ancient models implies deception, we desiderate that reality which could alone ensure successful imitation. Costliness and ornament should be regarded only as a step in advance of plainness and simplicity. The same elements of beauty are contained in both, but in one only is it developed. The absurdity, therefore, of ornamental meagreness instead of simple massiveness is evident, since decoration was never intended as a substitute for, but only as an addition to, solid and substantial construction. Yet upon this false principle modern churches are almost without exception erected.

We have ventured to offer the above remarks chiefly, as will be readily understood, in reference to designing small early-English churches, from a conviction that architects are often content rather to copy one another and the depraved fashion of the day, than uniformly to make antiquity alone the test of correctness in their compositions. By neglecting to do this, they have imperceptibly contracted a formality and a mannerism which is very detrimental to the revival of the art, and which nothing but a close adherence to ancient models is likely to remedy. Modern early-English, instead of being identical or at least closely allied with the style of the thirteenth century, is quite a distinct and isolated production, which in future ages will be regarded in the same light as we now regard the debased perpendicular, namely, an attempt to imitate its forms without a knowledge of its principles.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

April 4.—WILLIAM CUBITT, V.P., in the Chair.

"*On the Supply of Water to the City of Glasgow.*" By D. Mackain, M. Inst. C. E.

This paper contains a history of the progressive increase of the water-works of Glasgow, caused by the rapid extension of the city and its manufactories, derived from the documents in the archives of the Water Company, to which the author is the engineer. The statement commences from the year 1755, at which time Mr. John Gibson, in his History of the City of Glasgow, expressed a desire for several improvements, among which he particularly mentioned a better supply of water, as although the population amounted to 23,000 persons, the water used by the inhabitants was drawn from the Clyde, from the several streams running through or skirting the city, and from wells in the streets; the water from the latter was unfit for domestic purposes, and the manufactories gradually extending on the sides of the burns polluted their waters, and thus rendered a better general supply absolutely necessary. The various plans proposed in the year 1780 and subsequently are then detailed, and as an instance of the low estimate then formed of the quantity of water required for a community amounting to about 13,000 persons, it is stated that the produce of a spring at Whitehill, which it was then proposed to convey to the city for its entire supply, is now found inadequate for the wants of a house of refuge for juvenile delinquents lately erected near it. In describing the project of Mr. Henry Bell for bringing water by a canal from the Falls of the Clyde, his reasons are given for rejecting the use of steam-engines. "These engines," he says, "are not only in themselves objectionable, in so far as they will be hurtful to the value of surrounding property, and a general nuisance to that part of the city or neighbourhood where they are erected: but the consumption of coals which will thereby be occasioned will tend in no small degree to heighten the price of that fuel." An account is given of the speculation of Mr. Harley, who erected pumps at Willow Bank, and forced the water through pipes into a reservoir in Upper Nile Street, whence it was carted through the town, its sale producing a revenue of about £1000 per annum.

At length a water company was formed, and Mr. Telford was requested to report upon the proposed plans, all of which he found objectionable, and recommended that steam-engines should be placed on the banks of the Clyde, at a spot about two miles up the river, with the necessary reservoirs, filters, &c., and that the water should be forced by pumps into the city. He estimated that the quantity of water required for a population of 80,000 persons would be about 500 gallons per minute; that, including manufactories, the renters would be about equal to 6000 families; and that the average rent upon that number would be 2*l.* per family, which would produce £12,000 per annum. Acting upon this report, in the year 1806 the company ordered from Messrs. Boulton & Watt two engines with cylinders of 36 in. diameter, and laid pipes of 14 in. diameter to a reservoir on the spot, then called the Gallow Muir; from this small commencement sprung the present extensive works, whose gradual increase is carefully traced in the paper until the enumeration of its actual position in 1842, when the population of the city exceeded 300,000 persons, and the annual income was about £30,500, making the average payment about nine shillings per annum for each family. The works had increased until they consisted of thirteen steam-engines, of various powers, with their filters, reservoirs, &c., an accurate account of which is promised in a future communication. In this history many statistical details are given, obtained from the archives of the company; and the difficulties encountered by the engineers who preceded the author in the management of the works, are clearly described.

The details of the various oppositions from local interests, the several Acts of Parliament, the fluctuation of the mercantile value of the shares, the

history of the Cranston Hill Water-works, formed by a rival company, with whom for a time a ruinous competition existed, and whose works it became necessary to purchase, are given at length. The paper then describes the natural filter for the water, which was taken advantage of, by driving tunnels along the borders of the peninsula round which the Clyde sweeps in the form of a horse-shoe. This spot being composed of sand and gravel would, it was argued, form a filter, whence the water could be pumped up and conveyed across the river into the city. Many plans were designed for thus carrying the water; that which was adopted was suggested by Mr. Watt: he proposed the use of cast iron pipes, fitted, where necessary, with revolving ball and socket joints, which he then first introduced, and of which he sent a wooden model to the company, which model was now presented by them to the Institution of Civil Engineers. These pipes adapted themselves to the form of the bed of the river, and the plan was perfectly successful.

Mr. Telford's experiments upon stone pipes are mentioned, and some results are given. A stone from Rutherglen White quarry, 4 ft. 9 in. long, 18¾ in. square, with a bore in it 9½ in. diameter, when subjected to a pressure of a column of water from 60 to 80 ft. in height, split in the direction of the natural bed. Another stone from the same quarry, 5 ft. 2 in. long, 13 in. square, with a bore of 4½ in. diameter in it, did not emit any water until the pressure amounted to 100 ft. head; after that it discharged water freely, and split when the column a little exceeded 300 feet. A Portland stone, 4 ft. 6 in. long, 12 in. diameter, with a bore of 6 in. diameter in it, did not emit any water, nor was there any symptom of fracture under a pressure of 350 feet. Other stone pipes were also experimented upon with such various results, that Mr. Telford arrived at the conclusion, that they could not be relied upon, and accordingly recommended iron pipes.

The paper is illustrated by a large map of the city of Glasgow, upon which is shown, by different tints, the houses which existed when the water-works were commenced, the ranges of distribution, and the extent of the district for which the company is bound by Act of Parliament to supply water for certain periods during each day.

Remarks.—Mr. Simpson said that he was well acquainted with the works which had been described, as he had repeatedly visited them professionally; there were many points of interest attached to them, and the engineering operations were of considerable magnitude and importance. The late Mr. Watt suggested the idea of using the sandy peninsula on the opposite side of the river Clyde to the present works of the Glasgow company at Dalmarnock, as a natural filter, and it succeeded admirably, until the immoderate quantity of water was delivered to the city during the competition with the Cranston Hill Water Company. Of this spot, and the tunnels and wells in it, he presented a tracing. When he was at the works in the year 1833, Mr. Alexander Anderson, the then resident engineer, had been pumping water on to the peninsula for many months, and the deficiency of the natural filters, (nearly half the supply at the time) was made up by that means; at first the pumps were worked by rocking shafts connected to the engines across the river; afterwards pumps were erected close to the engines, and the water conveyed across the river through pipes. A very large portion of the supply to the inhabitants was drawn from the mains, without the intervention of cisterns, and a great deal of the water was thus wasted. The filter recommended by Mr. Telford was composed of a series of cells filled with sand, the water passing through them in succession; this filter was not effective during floods or when the water of the Clyde held in suspension the colouring matter from the peat-mosses; after passing through the first cell little more was accomplished, and the water continued discoloured.

Mr. Simpson had, however, seen the Clyde water filtered until it was perfectly bright, by conducting the process very slowly, the rate of motion not exceeding half an inch per hour through the medium—precipitation on the sand evidently took place; he had in some instances accelerated the precipitation by previous admixture of alumina or pipeclay and other materials, and had succeeded in throwing down the colouring matter, so that the filters produced perfectly pellucid water. In a filtering bed, properly arranged, the impurities were arrested at and near the planes of ingress—great extents of medium effected little in addition. In some filters which had been worked for nearly sixteen years, it had not been found necessary during that period to change the entire mass of materials. The natural filters of the Glasgow company had been injuriously affected by depressing the water in the wells, thereby increasing the pressure of the water on the bed and the foreshores of the river, and thus bringing the particles of the medium into too close contact and forcing obstructions between them. The Glasgow Water-works was an example of the employment of the largest steam-engine power for water-works purposes in Britain; he believed that at one period the engines at the works were equal to nearly 700 H.P. During the erection, in 1829, of the second pair of engines, with cylinders of 54 inches diameter, many difficulties were encountered; in the Vale of the Clyde, large quantities of mud almost in a fluid state lie intermixed with the strata. In sinking the wells for these engines, the mud was met with much nearer the surface than was anticipated, and when tapped, it rose up like a fountain in the bottom of the well; the pumps were, in consequence, fixed at a higher level than was originally designed. Mr. Crichton, of Soho, was of opinion that the alteration of 4 ft. 5 in. in the level of the pumps was immaterial; he probably did not calculate upon the water sinking in the filter-wells when the increased pumping power was applied.

Mr. John Gibb, of Aberdeen, who was consulted about the foundation, bored to 30 feet lower than the bottom of the new well, and found that the ground became weaker as the depth increased, so that any attempt to sink the well to the depth required would be very hazardous. He therefore advised the enlargement of the surface of the building under the whole superstructure, with due provision for the weights and strains in the arrangements; that a strong platform should be constructed of Memel logs and planking for the foundation, and the spaces between the timber to be filled in with masonry flushed in and grouted; this plan was adopted, and proved successful as a foundation, but the depth was insufficient, and the working barrels of the pumps were obliged to be fixed so much above the level of the filters, that they ceased to fill when the water in the tunnels was depressed 22 feet below the tops of the pumps. This was a serious disappointment to the company, for whenever the water in the river was low, a corresponding depression occurred in the wells of the filters; and in general, for many hours daily, these two engines only raised as much water as one would have pumped, if the working barrels had been fixed at the proper level. The suction-pipes were inclined towards the filter wells, and the pumps were distant from them about 110 yards; this, Mr. Simpson considered, was comparatively of little importance, as he had worked pumps with horizontal suction pipes 500 yards in length.

Mr. Hawkins recommended slow filtering, without pressure; some years since he had been engaged in refining sugar by Howard's process, by which the syrup was applied to the filter under a column of 20 feet in height; out of a certain quantity, 300 gallons were returned unfiltered, and by the time 60 gallons had been clarified, the filter was choked. He reduced the column to 2 feet, and out of the same quantity 6 gallons alone were returned, while 300 gallons were clearly filtered; this, and numerous other cases, had convinced him that pressure was injurious to filtration.

Mr. Braithwaite believed, that although slow filtration was generally preferable, yet that the velocity must depend upon the quality as well as the quantity of matter held in suspension; this consideration would also regulate the time during which the filter could be worked without cleansing.

Mr. Hawkins found practically, that half an inch in depth was the utmost that was required to be removed from the surface of the filtering medium when it was cleaned and renewed.

Mr. Simpson said, that in order to filter properly, there should be extensive reservoirs where all the grosser particles could subside or be arrested previously to arriving at the filtering medium; with due attention to this point he had seen filtering-beds worked for 67 days consecutively without requiring to be cleansed.

APPENDIX TO THE LAST PAPER.

"*Description of a cast iron Reservoir erected at Garnet Hill, by the Glasgow Water-works Company.*" By D. Mackain, M. Inst. C.E.

A considerable extension of the city of Glasgow is now taking place to the north-west of the old town upon an elevation of upwards of 100 feet above the river; the water-works, which are situated to the east of the city, are already upwards of 4 miles distant from the extreme point of delivery, which is almost daily becoming more remote, and the cost of the supply of water is consequently increased. These circumstances rendered necessary the establishment of a new reservoir, which should be sufficiently high and capacious to command and to supply the district. The ground which was obtained for this purpose was on the declivity of Garnet Hill, and had a fall of 20 feet in 90 feet extent. It was necessary to keep the bottom up as high as possible and yet not to contract the space by thick walls, and to erect such a building as should not be offensive to the neighbourhood; these considerations induced the author to recommend the use of iron plates for the reservoir, which should be masked by a screen of masonry designed by Mr. James Smith, architect of Glasgow.

The construction is thus described. A bearing wall of 4 ft. 6 in. in thickness was carried up from the foundation all round to within 1 foot of the floor of the reservoir. A division wall was built across the centre to carry the partition for dividing the reservoir into two parts. The space within these walls was filled in with broken stones, over which was a layer of clay, and then a layer of sand, upon which was placed a flooring of Arbroath pavement well jointed with cement, and resting at the sides upon the flanches of the sole plates, which were bedded in a mixture of lime and Roman cement, in such proportions as afforded ample time for the adjustment to be completed. The lower tier of plates was 1 inch, and the upper tier $\frac{11}{16}$ inch in thickness. Their flanch joints were made secure by inserting between the faces a lead pipe ⅝ inch diameter, filled with hat-gasket soaked in red lead and tallow, in addition to which the whole was caulked with a composition of hot lime and linseed oil, which in a short time became very hard. The reservoir is 123 ft. long by 85 ft. 6 in. wide, and 13 ft. 2 in. in depth; it is entirely covered by a malleable iron roof supported upon cast iron pillars.

The paper is illustrated by two drawings and four lithographs, giving the dimensions of every part of the work, and by a specification of the mode of execution.

Remarks.—Mr. Simpson said that he had examined the reservoir very carefully, and could bear testimony of the excellent manner in which the work was done. The mode of construction was novel, and had succeeded perfectly, as no leakage had occurred since its erection, nor had any inconvenience arisen from the variations of temperature, or from the unequal

depths of water in the two compartments. He thought Mr. Mackain was entitled to much credit.

Coradino Tank at Malta.

A drawing of the Coradino Tank, erected in 1841-2, in the island of Malta, was presented by William Lamb Arrowsmith, Assoc. C.E. (Superintendent of Government Works at Malta).

It was described as the largest modern covered tank in Europe, its cubic contents being 700,000 feet, and with its settling reservoir it would contain 15,000 tons of water; the roof was supported by rows of square pillars 15 ft. in height. It was intended to form a part of the works for supplying the island with water, a description of which was promised to the Institution to complete the paper on the supplies of water for cities, the first part of which has already been received.

ARTESIAN WELLS.

A letter was read from the late Sir John Robison, giving a short account of the *Artesian Well at the Abbatoire de Grenelle, Paris.*

The Abbatoire being at too high a level to obtain an adequate supply of water by the ordinary means, it was proposed, about eight years since, to sink an artesian well within the premises, which proposal having been agreed to, the execution of it was intrusted to Monsieur Mulot. The work having been perseveringly carried forward through many difficulties, the boring was terminated by the auger penetrating the water-bearing strata on the 26th February, 1841, when a sudden and violent rush of water occurred, overflowing at the surface of the ground. As the boring progressed, tubes of rolled iron, and subsequently of copper, were inserted to support the sides, the first being 12½ inches diameter, and the lowest about 6½ inches diameter, reaching to a depth of 1794½ English feet. The quantity of water thrown up while the bore remained in this state was about 880,000 imperial gallons per day, at a temperature of 82½° Fahrenheit; the expense incurred up to this time being upwards of £12,000 sterling. Sir John examined the theoretical reasons which had been given for the contortion of the tubes, which had been attributed to violent pulsations in the flowing water acting upon the outside of them, crushing them inwards; he objected to this reasoning as not being in accordance with the laws of hydrostatic pressure, and attributing it rather to mechanical causes arising from the force used in forcing the tubes down the hole, and even more to the violence they were subjected to in being withdrawn from it.

The letter was illustrated by a lithographic section of the well, which was presented by William Cubitt, Assoc. C.E.

Remarks.—Mr. Cubitt had recently visited the well, and found the water flowing with considerable force through an orifice in the vertical pipe about 8 feet beneath the level of the ground; the nozzle of the orifice, which was 10 inches diameter, was about half filled, and the stream was reported to be supplying about 2500 litres (550 gallons) per minute, at a temperature of 82° Fah. The water was not clear; it deposited a considerable quantity of fine sand, and occasionally stones of about 2 inches cube were brought up. He was informed that the water had at one period ascended to between 70 and 90 feet higher than the ground.

Mr. Taylor observed, that the temperature of the water nearly coincided with that of the United Mines in Cornwall, which were 295 fathoms, or 1770 feet deep. The highest temperature recorded there was, he believed, 96° Fah. It was well ascertained now, by the experiments of Mr. Fox, that the heat was not increased either by the decomposition of the pyrites, or the number of men and horses employed in the mines.

Mr. Enys said, that the experiments by Mr. Fox, as published in the report of the seventh meeting of the British Association (vol. vi, p. 135) gave a temperature of 92° in the lode at a depth of 290 fathoms, where it was first reached in the cross-cut, but on proceeding along the same cross-cut, at 10 fathoms from the lode, the temperature decreased to 86° 3′, and at 24 fathoms distant it was 85° 3′; this would give a close approximation to the temperature quoted by Mr. Cubitt.

Mr. Braithwaite inquired at what depth the temperature began to increase; landsprings were generally at about 52°, and he found the water in wells 600 feet deep usually at 53° or 54°. He had understood that the temperature increased 1° for every 65 feet, after a certain depth.

Mr. Enys said, that Mr. Fox's experiments gave a ratio of increase of 1° of temperature in 48 feet, calculated from the surface. He thought that the close approximation of the temperature of the land-springs, and that in the wells mentioned by Mr. Braithwaite, might be accounted for by the rapidity with which the water filtered through the strata of the London basin.

Mr. Taylor agreed that the heat of the water was influenced by the nature of the strata; the Cornish miners, when they were taken to the North Welsh mines, were much inconvenienced by the coldness of the water in the latter, although the depth of the mines in both districts was nearly identical.

Mr. Braithwaite believed that his view of the temperature of wells would be corroborated by the coldness of the water in the new well at Southampton, which had now arrived at a very considerable depth, and he understood that the temperature of the water was about 54°.

Mr. Simpson said, that the well at Southampton had been sunk and bored to the depth of 1063 feet; the supply of water was not considerable, and he was not aware that any observations had been made as to the temperature. A well at Chichester had now arrived at the depth of 1013 feet, and was still being carried lower.

Mr. Sopwith contended for the accuracy of the investigations of Count Brenner on the temperature of two German mines, and of Messrs. Fox, Buddle, and others in England; the differences between the results obtained were so trifling as to induce confidence in the conclusion they had arrived at, which was, that after allowing for the radiation of heat at a certain distance from the surface, the temperature increased 1° for every 50 feet in depth. This law might not hold good in certain local basins, where from the nature of the strata the percolation of surface water was rapid, but in the extensive mining districts it certainly was correct.

Mr. Cubitt suggested that the close approximation of the temperature of the water in the well at Paris and that observed by Mr. Fox at the same depth in Cornwall, might arise in some measure from the large volume of water in the former, and the rapidity with which it arrived at the surface: whereas in the deep wells which had been mentioned, the water had probably been allowed to cool before the temperature had been ascertained.

Mr. Clarke corroborated the opinion entertained by Mr. Cubitt; in a well which he had sunk to the depth of 540 feet at St. Alban's, he obtained, by an apparatus constructed for the purpose, some water from the bottom of the well, and found it 1° hotter than that which was pumped up from the same well. At the bottom of a well at Messrs. Barclay's brewery, 367 feet deep, the water was 3° hotter than at the water-level in the same well. Local causes frequently affected the temperature of water in wells; he had seen instances of the water being warmer at 60 and 70 feet deep than at 300 feet, but these cases would not influence the general law.

Mr. Vignoles considered the facts mentioned by Mr. Clarke to be very valuable, and as bearing out Mr. Cubitt's idea; there could be little doubt that if, by means of self-registering thermometers, the temperature of the water was ascertained, at the issue of the springs, at the bottom of deep wells which were not influenced by local causes, the result would prove in accordance with the observations of Fox and others. By the laws of the circulation of fluids the heavier water, which had been cooled at the surface, mingled with the lighter and warmer water as it rose; the sides of the well also tended to abstract the heat; therefore the temperature should be obtained at the greatest depth in order to make any correct experiment.

Mr. Braithwaite agreed in the influence of local circumstances; in a well at Cheshunt, at a depth of 40 feet, a sulphureous spring issued, the vapour of which almost killed the workmen: and when at last it was built out, the bricks continued so hot that the hand could scarcely be borne against them. Below that point very cold water was met with.

April 11.—JOSHUA FIELD, V.P., in the Chair.

THE WATER-PRESSURE ENGINE AT FREYBURG, SAXONY.

Description. By William Lewis Baker, Grad. Inst. C.E.

The machine described in this communication was designed by Herrn Brendel in 1823, and constructed in 1824, for draining the "Alte Mordgrube" mine, one of the largest silver mines in the neighbourhood of Freyberg, in Saxony. This engine, which is fixed at a depth of 360 feet below the surface of the ground, has two single-acting cast iron cylinders, each 18 inches in diameter, and 9 feet stroke, to the pistons of which are fixed strong timber piston rods, each attached at their upper ends by a flat iron rod and chain, to the opposite segments of a horizontal working beam, thus connecting the pistons of the two cylinders, so that, when one is being moved upwards by the pressure of water underneath it, the other is depressed by the weight of all the pump-rods and other moving parts to which it is connected. The admission and eduction of water from the cylinders is regulated by slide valves worked by levers and tappets. The piston-rods give motion to the horizontal arms of two bell-crank levers, the diagonal arms of which move the main pump-rods, working 44 pumps in two sets of 22 each placed one above another, at an angle of 45° with the horizon, each dipping into the delivery cistern of the pump immediately below it; this is repeated downwards for the whole series; and thus the water is raised from the bottom of the mine to the point where it runs off by an adit. Each pump has a lift of 30 ft. 4 in. The duty performed by this engine is stated by Gerstner[1] to be as 70 to 100.

The author then gives a very minute account of the construction of the engine, illustrating the paper by three drawings giving the general arrangement and the detailed dimensions of all the working parts.

Remarks.— Mr. Taylor remarked that the water-pressure engine was of Hungarian origin; it was extensively used in Germany, and had latterly been much improved in construction, particularly by abandoning the rude mode of placing a series of pumps over each other, as had been described in the paper. He believed that Smeaton erected the first engine of the kind in this country. Trevithick built one about 40 years since, with cylinders of 30 in. diameter. Another was erected by Mr. Fairbairn, and since then, one had

[1] Gerstner, "Handbuck der Mechanick," published at Vienna in 1834.

been built, under the direction of Mr. Darlington, with cylinders of 50 inches diameter, and 10 feet stroke, worked by a force of water of 22 fathoms, through a descending column of 30 inches diameter; the pumps worked by the engine were 12 inches in diameter, raising water from a depth of 22 fathoms; the usual speed of working was four strokes per minute, but he had seen it attain six strokes. The concussion produced by the closing of the valve at the end of the stroke, was generally very prejudicial to these engines; but in that made by Mr. Darlington, it was diminished by allowing the large valve to close a short time before the stroke finished, and bringing the piston home with a small valve; by this means no noise was heard beyond that of the rush of the water, and the violent shocks were avoided.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THIRTEENTH MEETING, 1843.—*Held at Cork.*

"*On the Application of our Knowledge of the Laws of Sound to the Construction of Buildings.*" By Mr. Scott Russell.

The object of this paper was twofold—first, to apply our knowledge of the known laws of sound to the phenomena of speaking and hearing in a given building; and secondly, to develop certain laws of sound recently discovered, and not generally known; and to show their application to the same practical purposes. Part I. of the paper contained the application of the known laws of sound to the construction of buildings. The author prefaced this part of the paper by describing a form of building which had been found to be perfectly adapted to the purpose of seeing and hearing with distinctness and comfort. This arrangement of buildings had been described by him in a paper communicated to the Royal Society of Arts of Scotland some years ago, but had not been actually constructed on a large scale until lately, when a young architect, Mr. Cousins, of Edinburgh, having been employed to construct some large buildings, and alighting on this paper, adopted its principles. Buildings were now erected on this principle, and contained from fifteen hundred to three thousand people, whom they accommodated without difficulty, and with perfect comfort both to speaker and hearer. He had little doubt, from experiments he had recently made, that so many as ten thousand people might be so arranged as to hear with ease and comfort a good speaker. Mr. Scott Russell's principle of construction is to place the speaker in the focus of a curve, which he calls the curve of equal hearing, or the isacoustic curve; and to place the seats of the auditors in such a manner that their heads shall all be arranged in this curve.

"Let A B C D represent the vertical section of a building for public speaking, S the height of the speaker on his platform, D C the floor of the building; then, for the purpose that all the auditors should hear and see equally well, they should be placed on the line S R B of the acoustic curve. This curve is constructed in the following manner:—D C is first divided into equal parts to represent the usual breadth of a sitting, and vertical lines are drawn through these points. R being the place of the auditor 1, the place of auditor 2 behind him is assigned thus—join S R, and produce it to *a*—from *a* upwards set off *a* 2—9 inches, and 2 is the proper height of the next spectator. Then join S 2, produce it to *b*, and set off *b* 3—9 inches, and 3 is the place of the third spectator, and so on for the place of every spectator. Such was the vertical section of the building. The horizontal section was either circular or polygonal, having the speaker at the centre. This form had been found perfectly successful in affording the highest degree of comfort both to hearer and speaker; therefore he submitted it with confidence to the section, as a practical and established principle, more than as a mere theoretical speculation. The remainder of this paper was then adjourned till the next day.

"*Chromatype, a new Photographic Process.*" By Mr. R. Hunt.

We are indebted to Mr. M. Ponton for the discovery of the first photographic process in which chromic acid was the active agent. He used a paper saturated with the bichromate of potash, which, on exposure to sunshine, speedily passed from a fine yellow colour into a dull brown, giving, consequently, a negative picture. E. Becquerel improved upon this process, by sizing the paper with starch previously to the application of the bichromate of potash, which enabled him to convert the negative picture into a positive one by the use of a solution of iodine, which combined with the starch in those parts on which the light had not acted, or acted but slightly, forming the blue iodide of starch. These pictures are, however, tediously produced; they are seldom clear and distinct, and failure too frequently follows the utmost care. While the author was pursuing an extensive series of researches on the influence of the solar rays on the salts of different metals, he was led to the discovery of a process by which positive photographs are very easily produced. Several of the chromates may be used in this process; but the author prefers those of mercury or copper, the most certain effects being produced by the chromate of copper, and, indeed, in a much shorter time than with any of the other chromates. The papers are thus prepared; good writing paper is washed over with a solution of the sulphate of copper and partially dried; it is then washed with a solution of the bichromate of potash and dried at a little distance from the fire. Papers thus prepared may be kept for any length of time, and are always ready for use. They are not sufficiently sensitive for use in the camera obscura, but they are available for every other purpose. An engraving—botanical specimens or the like—being placed upon the paper in a proper photographic copying frame, it is exposed to sunshine for a time, varying with the intensity of light from five to fifteen or twenty minutes. The result is generally a negative picture. This picture is now washed over with a solution of nitrate of silver, which immediately produces a very beautiful deep orange picture upon a light dun colour, or sometimes perfectly white ground. This picture is quickly fixed by being washed in pure water and dried. The author remarked that, if saturated solutions were used, a negative picture was first produced, but if the solution were diluted with three or four times their bulk of water, the first action of the sun's rays was to darken the paper, immediately upon which a very rapid bleaching action followed, giving an exceedingly faint positive picture, which was brought out in great delicacy by the nitrate of silver. It is necessary that pure water should be used for the fixing, as the presence of any muriate damages the picture, and hence arises another pleasing variation of the chromatype. If the positive picture be placed in a very weak solution of common salt, the images slowly fade out, leaving a very faint negative outline. If it be taken from the solution of salt and dried, a positive picture of a lilac colour may be produced by a few minutes' exposure to sunshine. Prismatic analysis has shown that the changes are produced by a class of rays which lie between the least refrangible blue, and the extreme limits of the violet rays of the visible prismatic spectrum—the maximum darkening effect being produced by the mean blue ray, whilst the bleaching effect appears to be produced with the greatest energy by the least refrangible violet rays.

"*On the Construction of Leatley's Shadowless Gas-burners, and the Shape of Glass Chimneys for Lamps.*" By Mr. H. DIRCKS.

The object of the burner was to bring the gas issuing from the small orifices into direct contact with atmospheric air at the ordinary temperature. Mr. Dircks contended that the heating of the air previously to its combustion diminishes the brightness of the flame; because, while each volume of carburetted hydrogen gas requires ten volumes of atmospheric air for its perfect combustion, the expansion of the air by heat necessarily reduces the weight of oxygen contained in the same volume of air; and therefore unless some means be adopted of increasing the supply of air, the oxygen would be deficient. Another alleged advantage of the burner arises from the small quantity of metal through which the orifices are perforated, for by that means a smaller quantity of heat is abstracted in burning. The peculiarity in the form of the glass chimney consists in having the upper end enlarged. The effect of this enlargment, Mr. Dircks said, was to open the top of the flame and increase its brightness.

Mr. J. Taylor explained to the meeting the recent improvements of Dr. Faraday in the combustion of gas; and a short discussion arose, in which Mr. Hawkins and Dr. Scoresby took part, on the advantage of enlarging the upper ends, not only of glass chimneys, but of all chimneys for the combustion of fuel."

Tidal Observations.

Mr. J. S. Russell read a report of his observations on the tides of the Frith of Forth and the east coast of Scotland. The especial object of this series of investigations was to discover fully the nature and causes of some remarkable tides which exist in the Frith of Forth, and to connect them with observations on the adjacent tides, and likewise furnish some better data for the construction of practical tide tables for predicting the time and height of high water at these places. The methods of observation were distinct from those which had previously been made. Instead of merely observing the periods of high and low water, observers were placed to note the rising of the water every five minutes, night and day, for several weeks and months together. This was done at twelve places simultaneously, from Newcastle along the coast to Inverness, so that from 2,000 to 3,000 observations were got from the stations in the course of a day. These were daily transmitted to the central station, and immediately laid down geometrically on ruled paper, so as to represent graphically to the eye the outline of each tidal wave by a curve. From the form of the curve it was that the most important

results were to be obtained, although the undertaking was laborious. The results of the observations were most important and satisfactory. Two distinct set off tide waves visit together the east coast of Scotland, but one of them has hitherto been much neglected. One goes round the north of Scotland and runs south; a second comes northward from the Straits of Dover. These were demonstrated on two charts; the progress of these was exhibited. Their presence was seen in the whole Frith of Forth down to the open sea; but in the upper part of the Channel these double tides were thereby distributed, and rendered more visible. These tides had opposite inequalities which indicated their age and origin. The paper was of very considerable interest, and it was stated by Mr. Russell that the Ordnance survey had just been conducting a series of similar observations in Ireland.

Mr. Hopkins read a paper "*On the Motion of Glaciers.*" Glaciers are formed on inclined planes by the gradual fall of water, which is converted into ice. As the ice increases it gradually expands, but in the first instance the motion is scarcely visible. He said he had made several experiments to illustrate this subject. An inclined plane was erected, on which he placed a box of ice, which he then elevated to an angle of 3 degrees; the motion was at the rate of 7 inches per day; on being raised to 6 degrees, the motion increased to 12½ inches; at 9 degrees it increased to 23½ inches; and at 12 degrees to 18 inches, increasing in a very large proportion afterwards. He then endeavoured to ascertain the least inclination at which the ice would move, and found that it would proceed down an inclination of half a degree.

OBITUARY.

MR. JAMES HAKEWELL.

Died at his apartments in Adam Street West, Bryanstone Square, May 28 1843, in the sixty-fifth year of his age, James Hakewell, architect. This gentleman was principally known by publications on architectural antiquities and the fine arts. His first work was a novel, entitled "Cœlebs suited; or, the Stanley Letters," 1812. In 1813 he produced a large volume in imperial 4to. called "The History of Windsor and its Neighbourhood," with twenty-one engravings and fourteen vignettes from his own drawings, price five guineas. The views were from his own pencil. It was well received at the time, and many years after he was much gratified on receiving the thanks of Sir Jeffry Wyatville for the publication, coupled with the assurance that, in his alterations in that abode of royalty, he had endeavoured to carry out his suggestions. When the general peace opened the Continent to English travellers, he went to Italy, accompanied by his wife, whose taste and talents qualified her thoroughly to enjoy all the beauties of nature and art that were displayed before them, and there they passed the greater part of the years 1816 and 1817, which afforded the materials for a "Picturesque Tour of Italy," which was published, with sixty-three plates, in twelve parts quarto and folio, 1818-1820, illustrated by parallels of Dorton House, Hatfield, Longleat, and Wollaton, in England, and the Pallazo Della Cancellaria, at Rome. This is an interesting work, both in its literary matter and in illustrations. Among the latter are some engravings from fine drawings by Turner, one of which, a composition of Roman edifices, surpasses any picture by Pannini. This work was brought out with great care, and immediately obtained a high rank in the estimation of the public, which it is well qualified to retain, as, for accuracy of delineation, and excellence of engraving, it does not yield to any that sprung from that fruitful field. In 1825 he published, in folio, "A Picturesque Tour in the Island of Jamaica, from drawings made in the years 1820 and 1821." In 1828, "Plans, Sections, and Elevations of the Abattoirs of Paris, with consideration for their adoption in London," 4to. In 1835, "An Attempt to determine the exact Character of Elizabethan Architecture," 8vo. In the year 1840 he was engaged in furnishing drawings for a projected work on the Rhine, which it was intended should have been a counterpart to his "Italy," but which has never been published, the drawings remaining in the hands of the engraver. *Gentleman's Mag.*

THE NEW HOUSES OF PARLIAMENT.

THE interest which this extensive undertaking has excited in this country and on the continent, has rendered any information upon its present state and condition, and upon the progress that is now being made towards its completion, a matter of some value. A correspondent of the *Times* has furnished the following details, by which it will be seen that the undertaking is proceeding in a satisfactory manner.

Without going into the general plan of the work, which is, perhaps, more easily gathered from the descriptive plates, which are to be found in every shop window, delineating the figure and outline as also the ground plan of the building itself, it will be necessary only to call public attention to such parts of the works as are actually finished, or which are in course of progression at the present moment. In the first place, looking at the river front, the divisions of which it is composed (commencing from Westminster-bridge) will be found in the following state:—

North Return, or Serjeant at Arms' Residence.—The greater portion of the parapet is completed and ready for the roof, which is now preparing, and which will be of cast iron, covered with Westmoreland slates. The present height from the ground level is about 70 feet.

The North Wing and Towers, or Speaker's House—which are intended to be about 110 feet high, are proceeding rapidly, their present height being about 66 feet above the ground level.

The North Curtain, or Libraries and Committee-rooms of the House of Commons, are advanced to about the same height as the north return.

The centre portion, which will comprise the conference-hall, the public waiting-hall, the upper waiting-hall, the staircase and various large committee rooms, is fast proceeding, its present level being about 66 feet above the ground, but it will be eventually carried up considerably above the curtain portions, thus forming beautiful and effective towers over the peers' and commons' entrances to the terrace. The carving upon this part of the work will be of the most elaborate character.

The South Curtain or Peers' Libraries and Committee Rooms, are at present about the same height as the north return.

The South Wing and Towers, or Black Rod's and the Librarian's of the House of Lords residences, stand about 63 feet above the ground level, and will be precisely the same as the north wing.

The South Return, or the Lord High Chamberlain's apartments, are also about 63 feet above the ground level.

The exterior ornamental work and carving upon those parts of the building just described are perfectly astonishing, both from their extent, their minuteness, and the enormous amount of human labour lavished upon them. No description, however, will give more than a faint idea of the exceeding beauty and elaborateness of this part of the work.

Extending throughout the whole length of the river front or principal elevation, may be observed a band over the principal floor windows, containing a series in bold relief of the arms of the sovereigns of this country, commencing with William the Conqueror and terminating with those of her present Majesty. In the early arms, where there were no supporters (that is to say, from William I to Richard II), figures in the appropriate costume of the time have been introduced to fill up the spaces, and at the same time to illustrate some principal event in each reign. On each side of the royal arms are panels composed of sceptres and ribands, with mottoes and foliage peculiar to each house. Underneath the windows is a narrow band, with inscriptions in the style of black letter, bearing each king's name, when he began to reign and when he died, with its initials on each of the buttresses.

The principal cornice is enriched with figures of grotesque animals over small shafts, and the intermediate spaces are filled in with pateræ composed of heads, badges, and foliage, whilst over the whole of this there runs an enriched parapet having niches containing angels holding shields, with initials, &c. In the centre portion above the cornice, and over the two-pair floor window, are badges of the orders of the Garter, Thistle, and St. Patrick, surmounted with crowns; the panels on each side of which are enriched with the roses of York and Lancaster, with labels and mottoes.

On the Wing Towers.—On a level with the royal arms are panels with shields and crowns, bearing the crosses of St. George, St. Patrick, and St. Andrew, with the proper mottoes under each, and on either side of them are other panels similar to those on each side of the royal arms. The arms of Queen Victoria are on all the oriels with panels in side lights, composed of shields with the royal initials entwined with the rose, thistle, and shamrock, surmounted alternately with the crests of the three kingdoms. On the return of the wing towers in the same level are panels with the badges of the three kingdoms, with angels bearing swords of state, &c., and the four patron saints in four tiers of niches. Between these and in a band over the one-pair floor windows are their arms arranged separately, with roses and crowns in the intermediate spaces, and the different badges used by each separate house from the Conqueror to the present time. On the return of the river front, or principal elevation, we see on a level with the royal arms devices of the different sovereigns from the time of the Heptarchy to the death of Harold, both included, divided between the buttresses by four tiers of niches, with statues of each king together with their queens; underneath which, on a level with the same, is a small band containing inscriptions of a similar character to those on the river front, divided with shields and ribands, the shield bearing a monogram of "Anglin," and surmounted with a crown. The cornice is similar to that in the river front. In the parapets are niches over the statues, containing lions, holding shields, bearing initials, &c.

It is necessary to be particular in describing the various ornaments introduced on the external parts of the work already finished, not merely to show the wonderful labour, talent, and richness lavished upon the outside of the building—for, be it remembered, that these ornaments are neither of composition or of plaster, but hewn out of the solid stone—but also as an act of justice to a very young but deserving artist (Mr. Thomas), from whose design (subject to the approval of the architect) the whole of these wonderfully elaborate ornaments have been executed.

The general effect of this part of the work is exceedingly imposing, and in point of beauty and minuteness, is equal to that of any other Gothic structure in this or any other country. Amongst the other parts of this wonderful building is the Victoria tower, which is now progressing rapidly, and which is at present about 10 ft. above the ground. Much expense has been incurred, and great labour required to obtain a proper foundation for this portion of the work, owing to the quicksands and land springs which were found under it, but which have been entirely cleared out to a depth of 24 feet from the surface, to a good gravel bottom, which being surrounded with large elm

piles driven down into the clay, metallic concrete, 10 feet 7 inches thick, was thrown in, and a good firm bottom obtained.

In addition and adjoining to this are the Guard-rooms and Sub-hall under the Royal gallery, which are about eight feet above the ground level.

The Sub-hall under the House of Peers is carried up nearly to the principal floor level, as are the central tower and adjoining buildings.

The Sub-hall under the House of Commons is about six feet above the ground level, as are the Commons' residencies, comprising those for the chief clerk of the House and the librarian.

The clock tower at the north-west angle of the building has the foundation and groining to the vaults completed.

As regards the internal decoration of those parts already finished, it will be remarked that the only parts completed are—the Public Hall, with its chimney-piece, with bold jambs enriched with the several orders of knighthood, with their appropriate mottoes, foliage, &c., and having over the chimney-piece niches containing the lion and the unicorn separately holding shields. Over each entrance are the present Royal arms, the supporters holding banners with their respective cognizances. The spandrils and enriched mouldings are filled in with national devices, mottoes, and foliage.

In the Central Lobby attached to the Public Hall over the side entrances, are the Royal arms, with helmet and crest. On the sides of the doors are badges of the three kingdoms in high relief, surmounted with crowns, whilst underneath the windows are panels with sceptres, swords of state, and ribands, forming a proper device, and filled in with the national foliage. On the staircase, leading out of the Public Hall are windows with elaborate tracery, with a border of quarter foils, filled in with paterae, continued down with a series of shields.

These, it would appear, are the only parts which are finished in the interior up to the present time, but still even in this short summary enough is shown to display the magnificent style and character in which it is intended to carry out the plan of the New Houses of Parliament.

In addition to those parts of the building which came under the observation of our correspondent, the most striking object was a pattern of the ceiling, which it is proposed to place in the two halls, which Peers and Commons are actually to occupy. These ceilings are to be of wood, and are to be formed in 18 compartments, divided by spandrils springing from corbels; each of these compartments are about seven feet square, and have upon their face a plain, but exquisitely beautiful, raised pattern, traced from the design of Mr. T. Dighton, the artist. It is understood, also, that these ceilings are to be in colours, and when completed, we have no doubt, they will be magnificent. Taken altogether, the works would appear to be proceeding satisfactorily. Our correspondent states that about 600 persons are employed actively upon them; and it is hoped that the part intended for the House of Lords will be ready for use in about a couple of years.

When finished, there can be no question that there will be nothing in Europe superior to them, either as regards the taste and magnificence exhibited in the design, the magnitude of the building itself, or the exquisite workmanship apparent in every part of it.

RAILWAY CHRONICLE OF THE MONTH.

Greenwich Railway.—The half-yearly meeting of the Greenwich company was held on Tuesday the 1st. The report showed a falling off in the traffic, as compared with the corresponding period of 1842, of 119,000 passengers and £2327. There was no dividend for the original shareholders, who feeling that the course which had been pursued under their sanction, had been wholly unsuccessful, carried the appointment of a committee of inquiry to consider what means there were of arranging with the other companies as to the toll to be paid over the Greenwich line, what alterations were necessary in the fares, and to investigate into the whole management of the concern *ab initio*. It is to be observed, that the existing board came in under a committee of inquiry some years ago. On the 15th, the meeting was again held by adjournment, when a report only as to the fares was given, recommending reduced fares of 8*d*., 6*d*., and 4*d*., return tickets of 1*s*. and 10*d*. for the 1st and 2nd classes, and annual subscriptions of 12 guineas and 10 guineas for the first and second classes. Another adjourned meeting was held on the 24th, when it was resolved to accept the mileage principle, but with a guarantee that it should not fall below a certain amount, £13,000 being the amount contended for by the Greenwich.

Grand Junction Railway.—The meeting of the company was on the 3rd; the chief features of interest are a decrease on the receipts of £22,512 11*s*. 11*d*., and in the expenditure of £1?,653, on the corresponding half year of 1842. Dividend at the rate of 10 per cent per annum. No allowance made this half year for the depreciation fund.

The Manchester and Bolton Railway Company report that they have agreed conjointly with the Lancaster Railway proprietors to supply locomotive power to the Bolton and Preston Railway company. They have also commenced an improvement of the canal navigation, which will render it capable of admitting vessels of 68 feet in length, 14 feet 2 inches in width, and drawing 4 feet 6 inches water, boats hitherto being restricted to about 3 feet draught of water. This is to improve the coal traffic. They state that the colonnade, forming part of the connecting line with the Liverpool and Manchester and Manchester and Leeds at Manchester, is nearly completed, little remaining to be done but to lay the rails. The dividend was 1*l*. 7*s*. 6*d*. per share.

The North Union Railway Company recommends a decrease of dividend, and state the diminution of passenger receipts at £2000.

The Chester and Birkenhead Railway Company mention a decrease of 3979 passengers and 552*l*. and in the expenditure of £3210. The arrangements for the tunnel from the Birkenhead station to Monk's Ferry are mentioned as in progress. The dividend was 7*s*. 3*d*. on the original shares of 50*l*. A resolution was carried in favour of low fares.

The York and North Midland Railway meeting was held on the 4th, and a decrease was stated in the passenger receipts of £2200, an increase in goods of £2682, and a reduction in the expenses of £1000. The dividend recommended was 2*l*. 10*s*. per share taking a small sum from the reserved fund. The Directors recommend the prosecution of a branch from York to Scarborough to join the Whitby and Pickering Railway.

The Leeds and Selby Railway is leased to the York and North Midland. The dividend declared was 2*l*. 10*s*. per share.

The Brighton Railway meeting was held on the 5th. A new board having been appointed, the report was principally directed to the arrangement of the accounts, which were in a defective state. It stated that eight contracts remained unsettled. A new wharf is mentioned as having been completed at Shoreham, for the reception of steam vessels of the largest class, which cross the channel from England to France; and also for the loading and unloading of trading vessels of greater burden, three of which can be accommodated at one time. An opinion was expressed favourable to an amalgamation of the locomotive power with the South Eastern and Croydon Companies. No dividend was declared, as the Directors had charged the interest account up to the date of making up the books, which had not previously been done.

The North Midland Railway meeting was on the 9th. A diminution had been effected in the working expenses of £11,530. A branch to Bradford was recommended to be prosecuted, and resolutions in favour of an amalgamation with the Midland Counties and Birmingham and Derby Companies. A dividend was recommended of 1*l*. 10*s*. per share.

We must observe that with nearly every Company a reduction or prospective reduction of the rate of interest on loans was reported.

The Northern and Eastern Railway meeting was on the 10th. The report states that Mr. Robert Stephenson has been engaged as engineer to the company, that a contract had been made with Messrs. Grissell and Peto for the entire construction of the Hertford and Ware branch, for £67,000, half to be taken in shares at par, and that the opening was expected in October. The Newport extension was to be begun on the removal of the crops. An extension to Cambridge was urged as necessary, and steps will be taken. The dividend was 12*s*. 6*d*. per share. A proposal from the Eastern Counties Railway Company for an amalgamation, not being adequate, had not been accepted.

The London and Birmingham Railway Company's meeting was on the 11th at Birmingham. It was stated that the decrease in the passenger receipts had been £13,113, increase on goods £10,019, and reduction in charges of £20,130. Dividend recommended at the rate of 10 per cent per annum. The works of the Warwick and Leamington Railway are stated to be let on satisfactory conditions.

The Midland Counties Railway meeting was held on the 10th. The Directors report the continuance of a contest with the Birmingham and Derby company about the traffic. The dividend recommended was 1*l*. 4*s*. per share. A resolution was passed appointing a deputation to confer with the Midland and Birmingham and Derby Railway Companies, as to the Chester amalgamation.

The Great North of England Railway meeting was held on the 8th. There

was an increase of merchandise traffic of £754. The dividend recommended was at the rate of 2¾ per cent per annum.

The Newcastle and Darlington Railway Company's meeting was held on the 4th. It stated that £155,000 had been expended, that the works were progressing, that the line would be opened on the 1st of July in next year, and completed 20 per cent below the engineer's estimate. A negociation for the purchase of the West Durham Railway was authorized.

The Sheffield and Rotherham Railway Company's meeting was held on the 12th. A falling off in the revenue of £900 was reported, and a saving of £900, principally in coke, by working the locomotives in conjunction with those of the North Midland Railway Company. Dividend recommended at 5 per cent per annum. Some altercation took place at the meeting as to the Committee of the Company having forced the Company to take some carriage wheels, which were not wanted. The prospect of a junction with the Sheffield and Manchester Company was stated not to be immediate.

The Bolton and Preston Railway Company's report was that they had opened the line to the junction on the 22nd of June, and that the contractors' accounts had been closed. The Directors recommend a double line of rails to be laid throughout the line. They report that they had leased their locomotive power of the Manchester and Bolton Railway Company, and Lancaster Railway Company. A kind of competition was going on with the North Union Railway Company.

The Great Western Railway Company's meeting was on the 17th at Bristol. The dividend was a reduced one of 5 per cent per annum. The passenger receipts had slightly diminished, and goods increased. The general expense had been diminished £5356. The buildings at the Bristol station, for the merchandise department, and at Swindon for the engine department, were represented as complete. The reconstruction of the permanent way between London and Maidenhead is recommended, the timber being of too light a scantling to be traversed by heavy engines at a high rate of speed. The conclusion of the arrangements for the completion of the Cheltenham and Great Western Union line is reported. The arrangements for the joint working of the Bristol and Glo'ster line are mentioned. The Oxford Railway is reported to be laid out, a contract taken for its completion in eight months; and it is to be laid with a double line of rails. A promise of co-operation with the Devon and Cornwall Railway Company is given.

A company has been brought forward called the *Eastern Union Railway Company*, for the purpose of extending the Eastern Counties by two short branches, one to Bury St. Edmunds, of 15 miles in length, and one to Harwich of 5½ miles in length, and also to embank about 2000 acres in the river Stour. The main line is proposed to proceed from Colchester by way of Manningtree, Holbrook, Ipswich, Needham Market, Stowmarket, Cotton, Diss, Eye, Scole, and Long Stratton to Norwich. The gradients are represented as favourable, maximum 1 in 152, earthwork very light, no lofty embankments, deep cuttings, or extensive viaducts. Cost estimated at £16,000 per mile.

The Devon and Cornwall Railway Company has received the promise of support from the Bristol and Exeter Railway Company, Bristol and Glo'ster Railway Company, and Great Western Railway Company. A large sum has been subscribed in Cornwall. Lady Bassett having subscribed for £5000, and given the land for two miles in length, Mr. Pendarves, M.P., having subscribed for £5000, and Lord Wodehouse and others having taken shares for their land.

It will be perceived that among other new lines in progress are those from York to Scarborough, and from Newport to Cambridge, and a branch to Harrowgate.

The Blackwall Railway meeting was held on the 22nd. A deficiency in the revenue account was reported, so as to make it inadequate to meet the expenses, the number of passengers had, however, nearly reached the former number. A change was made in the board—the chairman (Mr. Routh) and half of the Board going out—the remaining five directors and five new members constituting the new Board.

The South-Eastern Railway.—At a special meeting of the shareholders on Friday, July 21, the Directors obtained power to raise loans for the following works. For the extension of the line from Corbett's Lane to the Bricklayer's Arms, a distance of about two miles, and forming a station at the latter place. £177,777; this sum does not include the whole cost of the branch: a portion of the expense is to be raised by the Croydon Railway. For the formation of a branch railway to Maidstone, a distance of 10 miles, £149,300, to be constructed under the superintendence of Mr. Robert Stephenson, and finished within 12 months after obtaining possession of the land. —For the formation of a branch railway to Folkestone Harbour, and for the purchase and formation of the harbour, £266,600; the sum of £18,000 is the amount agreed to be paid for the purchase of the harbour: it comprises an area of 10 or 12 acres. Mr. Cubitt, the engineer, stated that the largest vessel that can now enter the harbour is 300 tons burthen, that is 250 register. The largest which it will be able to accommodate will be 300 tons, and the number of small and large vessels about 80 to 100. A pier is to be constructed 500 feet long, and which will be carried out 200 feet in 10 or 12 feet water.

The London and Croydon Railway.—At a special meeting of the shareholders on 25th July, the Directors obtained power to raise £70,000 for the formation of the branch from near New Cross to the Bricklayers' Arms, being for £60,000, one third the proposed cost; the other two thirds to be raised by the South-Eastern; and £10,000 for reconstructing a portion of the present line to unite it with the proposed branch. It is expected the branch will be finished by next spring.

Eastern Counties Railway.—The meeting of this company was held on the 24th. The report states that most of the contracts have been closed, and that new contracts have been entered into to fill up with soil the Mountnessing and Shenfield timber viaducts, which it is expected will be effected in six weeks. Orders have also been given to fill up the Lexden timber framings. It is stated that this is not done from any apprehension as to the safety of the viaducts, on the part of the Directors, but on the part of the public. Not the least settlement is, it is said, perceptible. The Directors express their satisfaction with the progress of the traffic, and declared their intentions of again prosecuting the application for the branch from Stratford to the Thames. They also ask power to negociate with other Companies for the formation of extension lines. They express themselves favourable to leasing the Northern and Eastern. A dividend was declared of 5*s.* on the new shares and 1*s.* on the old shares.

Bristol and Exeter Railway.—This meeting was held on the 23rd. The report states the probability of an earlier opening to Exeter than had been before promised, so as to open the line throughout on the 1st of July, 1844, viz., a year before the period anticipated. The dividend was 1*l.* 8*s.* per share. With regard to the proposed Devon and Cornwall Railway, the plan of assistance is stated. The Bristol and Exeter to contribute £200,000, of the proposed capital, the Great Western £150,000, and the Bristol and Gloucester £50,000, the rest of the capital, £800,000, to be raised from the public. The tunnel on the Bristol and Exeter is the chief work remaining uncompleted. With regard to this some delay had taken place, from the failure of a contractor, but additional shafts have been commenced, and every thing done to expedite the work. About one-third of the whole length is excavated, and the work is proceeding at 22 different faces, and will be in a short time at 28 if required. The stations are to be let in a few days.

Birmingham and Gloster Railway.—The meeting of this Company was held on the 25th. It intimated a slight increase in the receipts, and a diminution in the expenditure to the extent of £2,363. The dividend declared was 12*s.* per share. One chief feature in the proceedings was a long discussion as to the disposition of the Great Western Railway to lease the line, and as to the mode in which the negotiations had been and were to be conducted. Another feature was the defeat of the Board in the election of Directors. The four vacancies were filled up by the opposition, who carried the day with a large majority, by means of the use of stamped proxies.

Bristol and Glo'ster Railway.—This meeting was held on the 24th. The report states that the branch at Bristol to join the Great Western has been contracted for. It is 1,100 yards in length, and will be completed in four months. It states too that no arrangement has been made with the Great Western as to the working of the line.

Birmingham and Derby Railway.—This meeting was held on the 25th, when a dividend of 5*s.* per share was declared. As the question of amalgamation with the North Midland is to come before a special meeting, no feature of interest transpired.

UNION OF RAILWAY.—The *Derby Reporter* states that "the committees ap-

pointed by the shareholders of the Midland Counties and North Midland Railways have met and agreed upon the terms for amalgamating the three lines, the North Nidland committee having had authority to negotiate for the Birmingham and Derby Railway. The terms, we understand, are, that the shares of the North Midland and Midland Counties' Companies are to rank equal, but the 100*l.* shares of the Birmingham and Derby are to receive 27*s.* 6*d.* per annum less dividend- other shares in proportion. It now only remains for the shareholders to assent, for which purpose special meetings will be held as soon as the forms will admit."

TABULAR STATEMENT FOR THE HALF YEAR, DECEMBER 31, 1842, TO JUNE 30, 1843.

RAILWAYS.		....	....	RECEIPTS.			PAYMENTS.							....
Names.	Lgth in mls.	Total Expenditure.	No. of Passgrs.	Passgrs.	Goods.	Total.	Locomotive Power.	Carriages.	Maintenance of way and Reprs.	Office Department.	Taxes and Rates.	Total Charges.	Interest.	Profit.
		£		£	£	£	£	£	£	£	£	£	£	£
Greenwich [1]	3¾	1,030,108	705,201	21,313	..	26,587	3,500	3,190	1,041	1,551	3,301	13,957	11,550	1,080
Grand Junction [2]	88¾	2,375,131	..	132,976	19,652	185,093	20.298	29,692	12,675	1,591	2,954	80,320	..	104,772
Manchester and Bolton ..	10	777,956	139,408	11,571	6,293	17,811	1,095	3,110	732	751	268	5,959	5,282	9,008
North Union	22	613,212	..	17,731	6,793	25,337	1,166	2,142	1,171	1,236	1,082	7,397	3,219	14,690
Chester and Birkenhead ..	14½	509,810	..	11,191	1,298	13,307	2,110	2,382	1,089	237	172	5,990	2,525	2,837
Leeds and Selby [3]	20	..	99,782	3,756	8,158	11,911	..	1,251	567	411	177	2,739	..	9,175
Brighton [4]	56	2,792,193	..	65,187	9,002	71,190	9,168	18,150	4,980	3,117	3,003	19,827	13,974	..
North Midland	72¾	3,121,766	..	56,551	16,263	102,814	10,267	13,922	9,012	1,100	2,659	36,760	21,200	44,854
Northern and Eastern Counties [5]	32¼	887,055	..	31,853	3,693	35,517	6,702	6,945	2,033	..	895	20,321	5,695	10,875
London and Birmingham [6] ..	112½	5,953,831	..	306,157	84,735	389,658	32,854	11,141	22,151	5,615	8,717	112,238	39,680	223,924
Midland Counties	57	1,725,693	..	40,121	21,061	62,321	10,780	9,198	7,105	3,383	1,378	32,141	12,813	17,367
Great North of England ..	71	1,230,604	61,177	19,751	13,225	32,979	2,830	3,197	3,700	1,844	1,181	12,355	11,202	7,000
Sheffield and Rotherham [7] ..	5¼	..	185,231	7,040	953	8,116	..	2,107	186	371	120	3,381	1,199	3,578
Bolton and Preston	14½	373,925	..	3,846	1,168	5,315	2,000	1,170	185	..	92	3,117	..	1,867
Great Western [8]	118¼	6,651,928	725,127	254,603	75,100	330,003	33,103	54,610	23,985	1,118	8,592	159,232	86,836	82,886
Liverpool and Manchester ..	51	1,578,601	225,728	60,752	18,217	108,960	10,182	27,698	1,110	2,193	3,608	48,121	3,777	57,062
Blackwall	3¾	1,289,080	..	17,351	927	18,505	..	..	600	..	1,198	15,385	5,553	..
Eastern Counties	50¾	2,718,620	999,683	..	..	13,182	1,551	3.711	2,552	1,284	1,520	20,355	2,116	20,710
Birmingham and Glo'ster ..	55	1,170,730	..	35,514	7,101	12,618	7,968	6,956	6,111	1,290	382	26,045	13,633	1,266
York and North Midland ..	27	673,056	165,627	26,369	13,388	45,163	5,816	5,145	1,177	162	971	13,601	3,958	27,600

[1] Greenwich Railway received for foot passengers £497, and toll, £1,716. [2] Grand Junction paid Liverpool and Manchester Railway £8,016, and for rent £2,093. [3] Leeds and Selby locomotive power is included in York and North Midland. [4] Brighton paid Croydon and Greenwich Railway for toll £11.109. [5] Northern and Eastern paid Eastern Counties Railway for toll £5,749. It should be observed that the office expences cannot be separated. [6] London and Birmingham paid Aylesbury Railway for rent £1,250. In addition to the total outlay there is the sum of £13,966 carried to the depreciation fund. [7] Locomotive power not kept distinct. [8] Great Western paid Bristol and Exeter and Cheltenham Railway for Rent £34,184. In addition to the outlay £5,000 is carried to the depreciation fund.

MISCELLANEA.

The Prince of Wales.—This new iron steamer, built by Messrs. Miller, Ravenhill and Co., and fitted with a pair of beam engines of 130 H.P. also by them, taken out of one of the old Margate steamers, and with new tubular boilers, is the fastest boat on the river Thames. Her symmetry calls for the admiration of all who see her, and she has made the passage from Blackwall to Margate in the astonishingly short space of 3 hours 56 minutes, true railway speed. We must not abstain from mentioning the beautiful manner in which the saloon has been decorated, and which we understand was executed by Mr. Bielefeld, with the assistance of Mr. Steedman, who painted the beautiful views adorning the sides. The accident which lately happened to the vessel was caused by one of the middle side beams of the engine breaking, and before the engine could be stopped, they made six or seven strokes, which caused part of the machinery to punch a hole through the bottom about 6 or 7 inches diameter, through which the water rushed and filled the engine room to the depth of 2 feet; but in consequence of the vessel being built with water tight bulk heads not a drop of water entered either cabin: this incident proves how desirable, nay, absolutely necessary it is that all passenger steamers should be thus built, the engine room being the compartment perhaps most liable to casualties. The vessel was immediately taken into dock and examined, the aperture quickly repaired, and when she left the dock she was reported to be as sound as when first built. Her engines also when repaired were in equal condition, and the vessel is now running again with as great success as before the casualty occurred.

The Cartoons.—The Exhibition will be closed on Saturday the 2nd inst. The premium of 300*l.* awarded to Mr. Armitage for his Cartoon, representing "Cæsar's Invasion of Britain," was withheld in consequence of the drawing having been executed in Paris; and, agreeably to the conditions originally laid down by the Commissioners, Mr. Armitage was required to execute another drawing, the subject "An Ancient Briton defending his wounded Son from the attack of a Roman Soldier." This he has done to the entire satisfaction of the Commissioners, who have now paid him the premium.

Russian Steamers.—Messrs. Rennie have just completed an order for the Russian Government consisting of an Iron Sailing Vessel, and an Iron Steamer, with a pair of 50-horse direct-action engines; the latter is a splendid specimen of workmanship, and no doubt will be equally as effective on trial as their appearance leads us to expect; both the engines and the iron steamer will be sent out in pieces in the iron sailing vessel, and put together in Russia. The steamer is intended for one of the inland lakes.

Trafalgar Square.—The bronze ornaments of the Corinthian capital of the Nelson Monument are now being fixed. The stone-work of the enclosure and the terraces are finished, and the two basins are in a forward state; they are to be supplied with water from a well, to be sunk down to the chalk at the back of the National Gallery, and which is to be forced up by engine power to the cisterns on the top of the National Gallery, and thence by pipes to the fountains. The water will also be made available for other purposes, such as supplying the Gallery and Barracks, and also for watering the roads; there is some talk of suppling the public offices of Whitehall with water from the same source, which will cause a great saving to the public, as these offices are all supplied by the water companies.

THE ATMOSPHERIC RAILWAY.—We perceive by the Irish papers, that a preliminary experiment of the principle upon which the atmospheric railway is to act was made on Saturday, 19th Aug., and it is reported to have answered in every respect the expectations of the patentees, Messrs. Clegg and Samuda, as well as of all those concerned in the introduction of this most important national project into Ireland. The experiment was one made solely for the satisfaction of the engineers, the works being as yet in a very crude and imperfect state, and owing to the long continuance of dry weather there being scarcely as much water in the reservoir as would charge the boilers. At five o'clock the scientific gentlemen interested arrived, and the steam was soon after laid on, when the leviathan air pump commenced its labours—the mercury in the barometer soon displayed with what success. In sixty strokes an altitude of twenty inches was obtained, and shortly afterwards it reached twenty-two inches. This was the realization of the most sanguine expectations, and left no room for doubt as to the completeness and power of the machinery and its capability of producing sufficient vacuum. Thus far having progressed—the next course pursued was to introduce the piston into the tube at the equilibrium valve near Glasthule bridge; but while this was being done the key of the fly-wheel slipped, and a delay of nearly an hour elapsed before it was adjusted. It has been stated before that the experiment was but preliminary, and to this may be ascribed this trifling incident for accident it cannot be called. The fly-wheel movement being rectified, the engine was set going once more, but not on its condensation principle, for there was no cold water to condense. It was at high pressure and half power; the height of mercury in the gauge varied from 11 to 14 inches. The signal was given, and the piston carriage, with two passenger carriages, one second and one third class, attached, moved along *per se* amid the joyous shouts of those assembled. In four minutes they accomplished the distance, one and a quarter miles, retarded considerably at starting by the breaks on the wheels to keep the motive power under proper control, as also at the terminus, not to let the train overshoot the line of rails. A few data of the line of railway and the machinery may not be uninteresting. When finished there will be in length 9 209 feet of open or valve pipe. The close pipe forming the connexion with the air pipe is upwards of 400 yards. The engine is 100 horse power, to be worked on the expansive condensation principle. The air pump is double stroke, its diameter 67 inches; the diameter of the tube or open pipe 15 inches. The station at Dalkey is 76 feet higher than that at Kingstown. The elevation varies—1 in 57 being the greatest, 1 in 240 being the least, and the mean ascent being 1 in 115. It is computed that the train will descend from Dalkey by its own gravity, at the rate of from 30 to 35 miles an hour. The sharpest curve is only 547 feet radius.

THE CATHEDRAL OF GLASGOW.—Amongst other relics which have been turned out of the cathedral in the general clearing up, there is one for which we hope a place may yet be found within the pile where it has stood, we have no doubt for much more than 1000 years. This is a large block of blue marble, 10½ feet long by 5 feet broad, and 6 inches thick, which at present lies in the churchyard. It was found in the chancel of the Old Barony Church, near the tomb of St. Mungo, and from its appearance altogether there is every probability that it has been used either as the top or the base of the high altar of the old church. The marble appears to be of the same kind as that of which the ancient tombs at Iona are formed, and probably enough came from the same quarry. There is nothing similar to it at any rate in this quarter, and the material is more durable that granite. The stone is cut as if a plate or some kind of metal or other had been sunk into it. There is another octagon altar-piece of the same material also lying outside, and in danger of being destroyed. At the period that this altar piece was discovered, namely, in 1800, there was a skeleton found in the choir, having 36 inches of a massive gold chain round the thigh bone. We trust that these relics will be preserved inviolate, indeed, we have no fear about the matter, when their supposed antiquity is known; but we have thought it our duty to direct attention to the subject, lest they should be broken up or sold, as it is said was intended. After the recent removal of the Bishop's Palace, a picturesque and most interesting ruin which stood on the banks of the Kelvin, to build a dyke for a kail-yard, we have but very little trust in some people's veneration for the antique.—*Glasgow Constitutional.*

A MONSTER BELL.—On Monday, Aug. 7, an immense bell, the largest ever cast in England, weighing no less than 7 tons, 11 cwt. 2 qr. and 12lb., was shipped on board the Lady Seaton, bound for Montreal, and lying on the Brandy-quay, London Dock. This splendid bell, which is intended for the new Catholic cathedral at Montreal, was cast at the foundry of Messrs. Mears and Sons, Whitechapel, and has attracted, since it has been finished, the attention of a vast number of persons. Some idea may be formed of the immense size of this bell, from the fact that it required 10 tons of fused metal to form the cast, and the casting itself weighs upwards of seven tons and a half, that its diameter at the edge is seven feet three inches, that its clapper weighs upwards of 3 cwt.; the wood work, which is composed of old English oak, one ton; the iron work more than half a ton, and that the bell itself is heavier than the Great Tom of Lincoln by 32 cwt. The bell, as has been before stated, has been paid for from a fund subscribed by the merchants, artificers, agriculturists, and inhabitants of Montreal, and has cost, with its woodwork, &c., upwards of 1,200*l.* The bell was removed on a truck drawn by eight horses, from the foundry to the London Docks, preparatory to being shipped on board the Lady Seaton, but the dock officers refused to allow it to pass over the bridge leading from the West to the Brandy-quay, as they were apprehensive the structure was not sufficiently strong to support so enormous a weight without being strongly propped, and it was obliged to remain on the West-quay, until the bridge was propped up as required, and the great bell was taken safely over, and afterwards shipped on board, a part of the deck being obliged to be cut away to admit it into the hold.

THE PRINCE'S PARK, LIVERPOOL.—The prizes offered for the best designs for terraces in the Prince's Park have been awarded as follows:—For terraces A and B, to Mr. Henry Currey, of London; for terrace D, to Mr. W. Papworth, of London. The elevations for terraces A and B are very beautiful. Mr. Currey was a pupil of Mr. Decimus Burton. We understand that two of the designs for terrace D were considered of equal merit; on this being declared, Mr. Hornblower, of Liverpool, who had sent in one of those designs, handsomely withdrew from the competition, he being in the office of one of the judges.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM JULY 31 TO AUGUST 25, 1843.

Six Months allowed for Enrolment, unless otherwise expressed.

William Davey, of Bath, slate merchant, for "*improvements in covering the ridges and hips of roofs of buildings with slate and other materials.*"—Sealed July 31.

Charlton James Wollaston, of Welling, in the county of Kent, gentleman, for "*improvements in machinery for cutting marble and stone.*"—August 1.

Peter Borrie, of Prince's-square, St. George's in the East, engineer, and Mayer Henry, of Crutched Friars, merchant, for "*improvements in steam-engine boilers and propelling machinery.*"—August 3.

Frederic Stainer, of Hyndburn Cottage, Lancaster, Turkey red dyer, for "*a new manufacture of a certain colouring matter, commonly called garancine.*" (A communication.)—August 8.

James Home, of Regent's Park, esquire, for "*improvements in the manufacture of horse-shoes.*"—August 8.

Charles Boujot, of Coleman-street, London, merchant, for "*improvements in apparatus for obtaining the profile of various forms or figures.*" (A communication.)—August 8.

Richard Archibald Brooman, of 166, Fleet-street, London, gentleman, for "*the manufacture of paper, cordage, matting, and other textile fabrics, from certain vegetable matters not heretofore made use of for that purpose, as also for the application of the said materials to the stuffing of cushions and mattresses.*"—August 10.

John Wood, of Parkfield, Chester, merchant, for "*improvements in machinery or apparatus for affording additional or artificial buoyancy to sea-going and other vessels, or for lessening their draught of water, and which said improvements are also applicable to raising vessels or other heavy bodies, and for securing or supporting the same.*"—August 14.

Archibald Horn, of Aldersgate-street, zinc worker, for "*improvements in the construction of shutters for windows, and other purposes.*"—August 15.

George Bennetts, of Gunnis Lake, Cornwall, civil engineer, "*for improvements in steam-engines and boilers, and in generating steam.*"—August 15.

Thomas Young, of Queen-street, merchant, for "*improvements in obtaining power.*"—August 15.

James Brown, of High-street-place, Stepney, engineer, for "*improvements in tackle and apparatus for working and using chain cables in ships and otherwise, and also improvements in the tillers of rudders of ships and other vessels.*"—August 16.

Frederick Lipscombe, of University-street, gentleman, for "*an hydrostatic engine, parts whereof are applicable as improvements to other engines and other purposes, and also improvements in railway carriages.*"—August 17.

John Collard Drake, of Elm-tree-road, Saint John's-wood, land surveyor, for "*improvements in lining walls of houses.*"—August 22.

Mark Freeman, of Sutton, gentleman, for "*improvements in card cases.*"—August 22.

Gaspare Conti, of Sherard-street, Golden-square, gentleman, for "*improvements in hydraulic machinery, to be applied as a motive power.*"—August 22.

William Fletcher, of Moreton House, Buckingham, clerk, for "*improvements for the purpose of securing corks, or substitutes for corks, in the mouths of bottles, or vessels of the nature of bottles, whether made of pottery, or of pottery of the kind called stone ware, or of glass.*"—August 24.

Alexander Connison, of Everitt-street, Brunswick-square, engineer, for "*improvements in steam-engines.*—August 24.—Dated March 3.

N.B.—This patent being opposed by caveat, lodged at the great seal office, was not sealed till the 24th of August, but bears date the 3d March last, the day the patent would have been sealed if the same had not been opposed, by order of the Lord Chancellor.

William Wilson, John Hudholme Brownrigg, John Cockerell, and Sir George Gerard de Hochepied Larpent, Bart., all of Belmont, in the Wandsworth-road, patent cocoa-nut candle and oil manufacturers, assignees of a patent granted by his late Majesty King George the Fourth, unto James Soames, jun., of Wheeler-street, Spitalfields, for "*a new preparation or manufacture of a certain material produced from a vegetable substance, and the application thereof to the purposes of affording light, and other uses.*"—For the term of three years from the 9th day of September next, the expiration of the original grant.—Aug. 24.

Bryan Corcoran, of Mark-lane, in the city of London, merchant, for "*improvements in the grinding of wheat and other substances.*—(A communication.)—Aug. 25.

KALSOMINE WASHABLE PAPER-HANGINGS AND DECORATIONS.—These Paper-Hangings are of every variety, and though not higher in price than ordinary papers, possess the valuable quality of washing and cleaning with *soap* and *water*, whereby light and cheerful patterns, so easily soiled by a London atmosphere, become as economic as the darker and more covered papers. Every pattern manufactured by the London houses may be obtained at the same prices at W. B. Simpson's, decorator, 456, West Strand.

TO ARCHITECTS, Builders, &c.—The advantages of J. FINDON'S improvement of WATER CLOSETS the great facility of acting, cleanliness, durability, and readiness of being connected to a pipe from a head of water, which pipe may be used for any other purpose, the whole of the apparatus being under the seat. Testimonials to be seen at the factory, 190½, High Holborn. N. B. Hoppe's Closet, with earthenware basins and trap complete, 23s.; if iron enamelled basins and trap, 25s. Iron cisterns, bends, connecting pieces, and traps to fit the iron soil pipes, very cheap.

Preparing for Publication.

THE ECCLESIASTICAL ARCHITECTURE OF GREAT BRITAIN, from the CONQUEST to the REFORMATION.

Illustrated by views, plans, elevations, sections, and details, of all the venerable relics of antiquity with which this country so richly abounds with an historical and descriptive account of the rise, progress, and development of those glorious styles of architecture which are now exciting the admiration and wonder of Europe.

By HENRY BOWMAN, Architect, and
JAMES HADFIELD, Architect.

Notwithstanding the many works on this subject which have appeared within the last few years, (some of them doubtless very elaborately and beautifully got up,) there is still, it is conceived, ample room for such a work as the one here proposed. Even the finest hitherto published, as those of Britton and Pugin, do not possess, by any means that accuracy of measurement and minuteness of detail, so necessary in works of this nature, and which constitute their chief value to the professional man. It is considered that the work now proposed will completely supply all defects of this kind, as the authors pledge themselves for the *perfect accuracy* of every detail professed to be laid down to scale: no part, whatever will be given on any authority but *actual measurement by one or other of the authors themselves.*

This work, when finished, will form a complete record of all the existing Ecclesiastical remains in this country, together with many valuable and beautiful specimens now destroyed, but of which drawings and measurements were made while they were in existence. The authors consider, however, that as many of the largest buildings, (some of the cathedrals for instance), have already been illustrated to some extent, it would not be advisable to include these in the work *at present*, but rather to confine themselves in the first instance to those examples which have never yet been published in detail.

But it is their intention, should they meet with that support which they anticipate, to include *ultimately every existing specimen*, believed to be genuine and of real value, so as to render the work complete; and it is well known that, with one or two exceptions, the works hitherto published, illustrative of particular buildings, contain only a comparatively small portion of the detail of such buildings, leaving perhaps parts of equal or even superior excellence unnoticed.

A very important and valuable feature will be added at the end of the work, and likewise at the end of each part, in the shape of an Index, in which all the individual component parts of each style will be arranged alphabetically, as well as chronologically, with copious references to the plates in the body of the work. Another very useful addition will consist of a short notice of the different stone quarries in each county.

It is intended also to include in the work all existing examples of ancient stained glass, a limited number of copies being coloured faithfully from the originals, but all figured and referred to a list of colours, so as to enable any one to colour his own copy for himself.

The work will be of a 4to. size and divided into parts, each comprising one whole county complete. The parts will be divided into numbers, each containing one or more whole buildings complete, according to their size. Thus, purchasers may obtain either the whole work or the particular counties or buildings in which they may be more immediately interested: the parts being of unequal size, but the numbers all uniform both in size and price. From the great extent of the work, it is considered desirable to give the plates in the most economical style of engraving consistent with accuracy and distinctness of detail. All extraneous matter will be avoided in the literary department, which will comprize nothing but what will contribute to the better understanding and appreciation of the beauties and characteristic of style in the examples given.

The authors are fully aware of the magnitude and responsibility of the work they thus undertake, but they are also deeply sensible of the value and importance of thus securing, if not from destruction, at least from oblivion, the numerous and inestimable remains of those venerable and majestic piles which once formed the glory of our land, and on which we must rely for success in our endeavours to re-establish integrity and purity of design. Moreover, the subject is one to which they are both ardently attached, and they feel confident, from the amount of matter already accumulated, (all the sketches and measurements for 27 of the English counties being already obtained), that they shall be able, if spared, and their work appreciated, to complete it without interruption.

The First number will appear sometime in September next, and will consist of ILLUSTRATIONS OF NORBURY CHURCH, DERBYSHIRE.

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The best white quality takes a brilliant polish, and the Scagliola manufactured from it, is allowed to excel all other imitations of marble in richness and depth of colouring.

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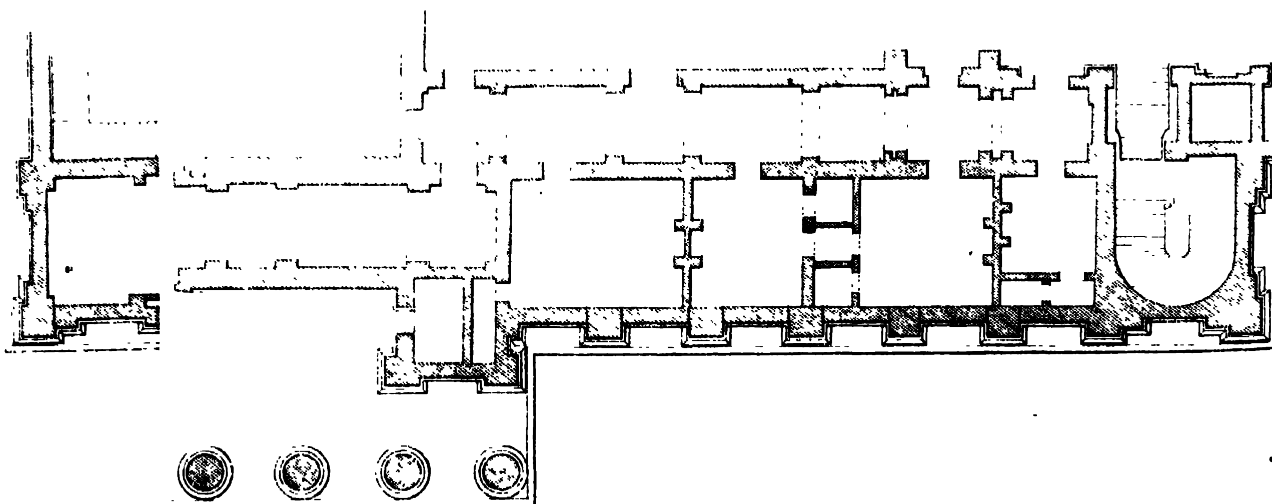
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rties; and should the purchaser or purchasers think it advisable to discontinue the working of the said quarry, after laying out a certain sum to be named by the vendors, in erecting machinery, &c., working the same in a proper manner, they may then give the same up to the vendors, and they would require no further remuneration than the first instalment, and the works as they then shall be, together with the machinery and materials, &c., erected thereon.—Royalty 1-9th of clear profits.

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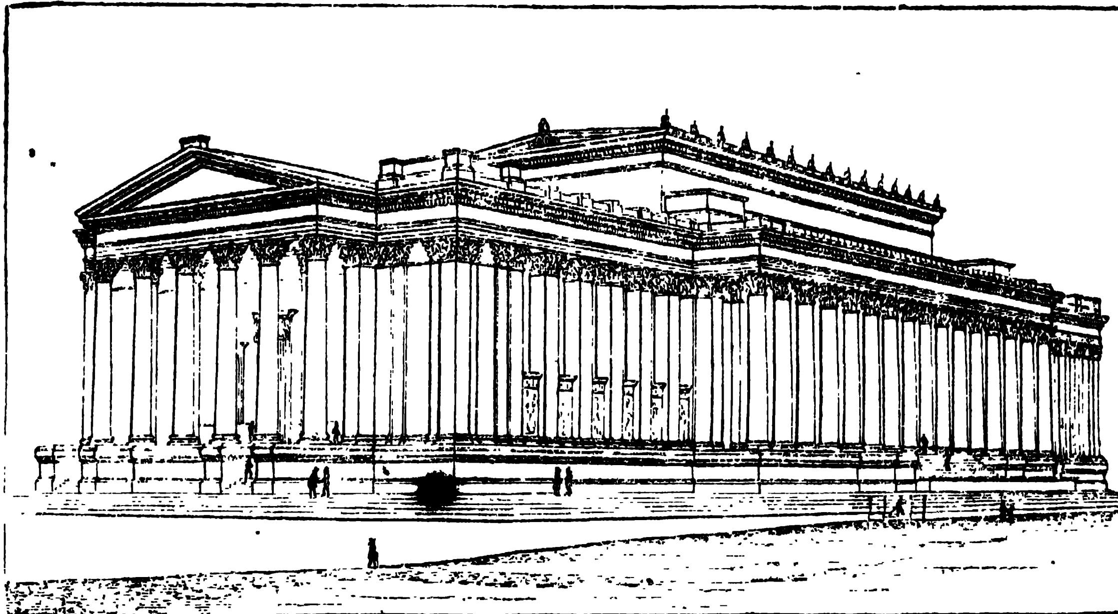
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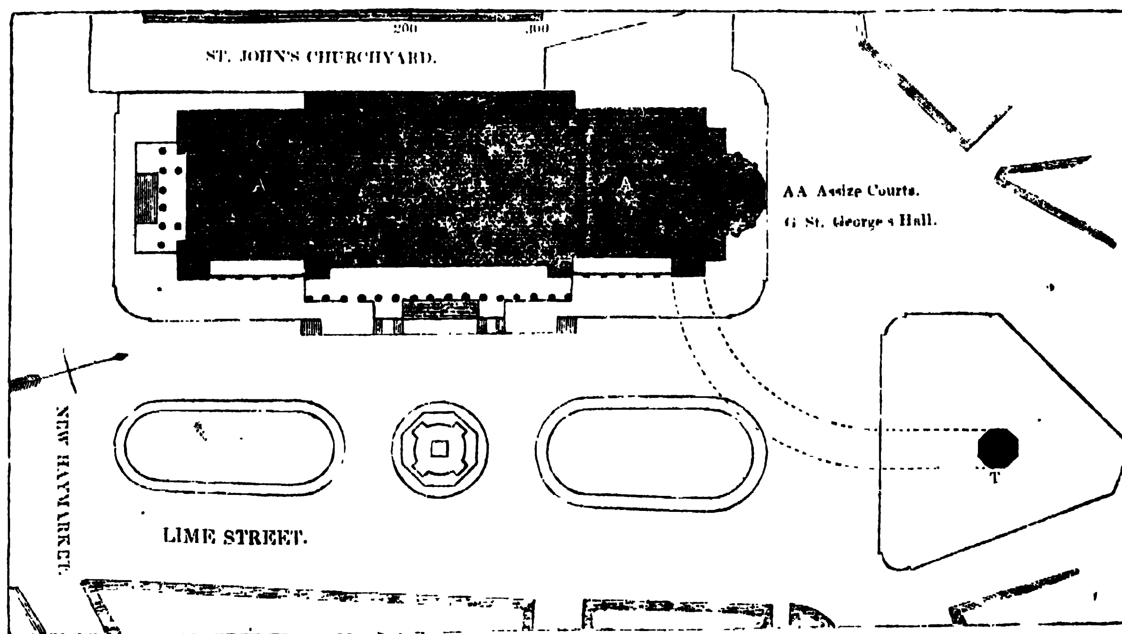
ST. GEORGE'S HALL AND THE ASSIZE COURTS, LIVERPOOL.

H. Lonsdale Elmes, Architect.

(With an Engraving, see Plate XII.)



Perspective View.



Block Plan of Situation.

It affords us much pleasure to be able to furnish our readers, through the kindness of the talented architect Mr. H. Lonsdale Elmes, with a copper-plate engraving of the principal façade of St. George's Hall, Liverpool, now in course of erection, and which, when finished, will justly be the pride of Liverpool; and from what we have seen of the designs of the interior, we can safely say that it will stand pre-eminently as one of the most noble buildings of this country. It is a pleasure to find, which we desire to see more general, that the Committee very ably support Mr. Elmes in his designs, and do not attempt to mar the general effect on the score of penury or false economy.

The judicious appropriation of the spaces with the recesses between the pilasters, for figures and bas-relievo is excellent; it will afford the Liverpool people an opportunity to display their patriotism by erecting statues with appropriate tablets below, in commemoration of men who have devoted their talents to the extension of the arts and sciences, to commerce and manufactures, such as Watt, Davy, Dalton, Brindley, Woolfe, Arkwright, Stephenson, &c.

The general dimensions of the building, with some very appropriate remarks, have already appeared in the "Companion to the Almanac" for 1842, of these, and the wood engravings, we shall avail ourselves, with some addition and correction; the wood engravings, although not strictly correct in all their details, are sufficiently so to show the general character of the building and its situation.

It was originally intended that the "Hall" and the "Courts" should form two separate structures; and ground for the purpose having been given by the corporation in the spring of 1839, premiums were offered for designs for the first-mentioned and shortly afterwards for the other building; and in both competitions (the first of 75, the second of 86 candidates) the first premium (250 and 300 guineas respectively) was awarded to Mr. H. Lonsdale Elmes, whose design for the "Hall" presented a Grecian Ionic colonnade, while that for the Assize Courts showed a Grecian Doric façade, consisting of a central portico and lateral colonnades immediately connected with it. According to the instructions first given, St. George's Hall was to have been on the site near T in the annexed block plan of the situation, while the courts would have been as at present, so that the two buildings would have stood at right angles to each other, the "Hall" with its principal front facing the south, the façade of the courts being to the east, and opposite that of the railway terminus, which is also shown in the plan. This arrangement was, however, subsequently abandoned, as St. George's Hall must have been *overlapped* by the other at its western extremity, it being impossible to set back the latter so as to clear the façade of the hall, and allow the whole of it to be seen in a front direction. As the successful competitor for both buildings, Mr. Elmes was accordingly instructed to remodel his plans, when it was finally determined to unite the two into a single pile, and, so altered, his design was finally approved by the Town Council (May, 1841), and the foundations shortly after commenced. The following perspective sketch will serve to show the general style and composition of the design. The order now adopted is Corinthian, continued throughout, and arranged so as to produce a very rich *polystyle* composition, possessing more than an ordinary degree of variety and contrast. In order to make up for the unfavourable impression attending the minuteness of the scale of the drawing, it must be borne in mind that the eastern façade, or the longer side of the building, is 420 feet, or only 38 less than that of the National Gallery, and much loftier, the columns being 45 feet high and 4 feet 7 inches in diameter. The south front, which owing to the great fall of the ground at the end of the site (about 16 feet), has the appearance of being raised upon a terrace, and thereby acquires both additional dignity and picturesque effect, consists chiefly of an octastyle diprostyle portico, recessed within so as to make its entire depth 28 feet. The columns are raised upon a stylobate 10 feet high, and continued along the other fronts, and the height from the ground-line to the apex of the pediment is 95 feet, which is only 6 or 7 less than that of the dome of the National Gallery. This front alone would constitute an imposing piece of architecture—and is upon a scale greatly surpassing anything of the kind yet erected in the metropolis—yet it appears little more than a subordinate portion of the whole when compared with the eastern façade. Independently of its beauties of design, this latter has the merit of clearly expressing the general internal arrangement of the plan: the advanced or monoprostyle colonnade in the centre is 200 feet in length, and, being recessed, forms within an ample sheltered ambulatory 26 feet in depth; this corresponds with St. George's Hall, which comes in between the two Assize Courts, and defines itself externally in the composition, by being carried up higher than the rest. This division of the front consists of 15 intercolumns, and the one on either side of it of 5 more. The architect has placed here square pillars, between which an ornamental screen is carried up below, while the upper part of their shafts are insulated; thus a double contrast is produced, first between the columns and the square pillars, next in respect to the closed and open spaces between the latter. The north front presents a projecting hemicycle in which the order is continued in attached columns; thus, while that part is so far in keeping with the rest, a very agreeable variety is produced, and the view of the building from the north-east differs considerably from that from the south-east, given in our cut. Whether contemplated or not, one advantage resulting from the north end of the building being brought out semicircularly is, that that projecting part will catch the sun much earlier than it would else strike upon a front so unfavourably placed as to aspect. This portion of the plan will form a concert-room to which there will be a separate entrance, and it makes the entire extent from north to south, including the steps leading up to the south portico, 500 feet. Taking into account its unusual altitude, this structure will in point of magnitude alone have very few rivals in the kingdom; and how far it will have any for beauty and magnificence as an example of modern Grecian architecture, we will leave our readers to judge.

As regards the interior, we shall at present content ourselves with merely pointing out its principal divisions and their intended purposes. St. George's Hall (indicated in the plan by the letter G), measuring 169 by 75 feet, and 85 high, will be further extended along the upper part of its sides by a series of recesses 13 feet deep, apparently obtained out of the thickness of the walls, but in reality coming over the corridors which surround this part of the interior, and both separate it from, and connect it with, the two Law Courts AA. On the west side of the hall the light will be admitted laterally through windows within those recesses, and on the opposite one through small domes, one in each recess. During the assizes this spacious hall will be opened to the public as the approach to both the courts. At other times it will be appropriated, at the discretion of the council, to public or private meetings. The two courts, which are lighted from above, are similar in size, viz., 60 by 50 feet, and 45 high; and the concert-room at the north end of the building is 75 feet from east to west, and of the same extent in the other direction, measured through the spacious hemicycle on its north side. The other principal apartments and their dimensions are as follows:—

	ft.		ft.	ft.
Vice-Chancellor's Court	25	by	29	18 high
Sheriffs' Jury Court	29	„	25	18 „
Grand-Jury Room	41	„	25	22 „
North Entrance Hall	74	„	52	30 „
South ditto	40	„	25	19 „
Barristers' Library	42	„	25	18 „

The whole of the building will be thoroughly ventilated under the joint direction of Dr. Reid and the architect, and in such manner that the whole power of the apparatus may be directed to any one or more of the apartments according as circumstances may require.

The building will be entirely faced with stone from Stancliffe Quarry, Darley Dale, near Matlock, Derbyshire, one of the specimens recommended by the Parliamentary Commission for the new Houses of Parliament. It can be obtained in very large blocks, which is an advantage for this style of architecture. Although the columns are 13 ft. from centre to centre, the architraves will be in one length. The great hall is to be vaulted with a semicylindrical vault of solid

brickwork, over a span of 75 feet, and springing at a height from the foundations of 73 feet, the crown of the arch being 110 ft. from the same. It is proposed to extend this permanent mode of construction to the two courts adjoining, which, if executed, will present a grand vista of vaulted ceilings upwards of 300 feet in length. From this we may hope that the architectural character of the exterior will be fully maintained in the interior.

The building is now rapidly advancing, and is carried up as high as the bases of the columns, and the contractor has undertaken to complete the exterior in 1845. The estimated expense, exclusive of ornamental fittings and finishings, is £125,000, of which sum the foundations and basement story have cost nearly £12,000.

CANDIDUS'S NOTE-BOOK.

FASCICULUS LIII.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. The group of three houses or mansions which are now erecting in Grosvenor Place, on the site of what was the Lock Hospital, although intended to be a superior specimen of the Italian palazzo style, *à la* Barry, with microstylar Ionic windows to the principal floor, as in the Reform Club-house, is very unsatisfactory, owing to the narrowness of the piers between the windows, which certainly do not allow space sufficient for such extended dressings to the windows as are here applied. The consequence is, the fronts look too much overdone in that respect, the parts being so much crowded together, as to lose their value; and the effect cannot, perhaps, be better described than that of a tasteful style treated without taste—which, odd as it may seem to a great many, is by no means an uncommon thing.

Apropos of architectural taste, it seems to be migrating eastward and cityward. There is a new stone-fronted building—as yet unappropriated—just by the church in Lothbury, and facing the Bank, which, though but of moderate size, being only four windows in breadth, is not a little remarkable for general elegance of character, and for careful finish of detail. This charming little specimen of the Italian *palazzo* style, would be an ornament even to Pall-Mall, for except, perhaps, just there, it has not a rival at that end of the town for refined simplicity and gracefulness. It deserves to be noted, also, that though the return on the west side faces a mere alley, the architecture is carried on there consistently with the front.

The new Brighton terminus, with its campanile, near London Bridge, will also, in point of design, be a more than ordinarily tasteful specimen of Italian. The bold rustication of the quoins contribute in no small degree to the expression and finish of the principal building, more especially as it is not confined to the external angles of the façade, but is repeated at those of the slightly projecting breaks, at the ends, in each of which is a door below and a window above; and in the intermediate part there are three windows on a floor.

II. There is, just now, an excessive deal of cant afloat about the moral influence of the fine arts, just as if the fine arts were not worth cultivating for their own sake, without any hypocritical pretence. Fudge! Talk of the moral influence of waltzing, or of the ballet as viewed from the pit at the Opera! I should like to know, if any one could explain it, what has been the amount of moral influence for good of all the fine arts, drama and literature included, in the civilized stages of society. Was the court of Leo. X remarkable for its correct morality? Was the "divine" Raphael himself a bright exemplar of moral purity? Only consider how many Madonnas have been painted from ladies who had qualified themselves for turning Magdalens. If, on the one hand, art has mainly served to perpetuate the puerilities of pagan mythology, so, on the other, it has kept alive the puerilities of papistical superstition. To us, therefore, who can sympathise neither with the one nor the other, it can have little value than what it derives from its mere æsthetic influence. All the rest is but mockery and delusion, carried on by gullibility on the one side, and humbug on the other. If art has no intrinsic worth in itself, and deserves to be encouraged chiefly as a means, not as an end, let us be honestly told so; and let us have done with cant and make-believe, and with all that frothy flummery with which penny-a-liners descant on art for the nonce in newspapers.

III. To what purpose do we take such pains to collect architectural and similar specimens of ancient art; or why should there be such a prodigious cackling on any thing of the kind, no matter how worthless it may be in itself, being brought to light, when some of the finest studies of the kind are neglected as soon as they come into our possession, without being turned to account in any way whatever? The examples, of ancient or antique columns and other architectural ornaments, to be met with either in museums or inserted in Italian buildings of later date, are almost infinite, both as to number and variety, yet who ever condescends to derive a hint from them? There are some fine things of the kind in the British Museum;—which of our architects has taken a lesson from them for any thing he has himself done? Of nearly all our modern buildings in the Grecian and Roman style, the detail looks as if it had been supplied from some "furnishing warehouse" for the purpose, where it is kept ready made. It is just the same with columns and entablatures, and it frequently looks as if they had been bought at different shops, or were very ill-matched. Hence it is little to be wondered at if, so mechanically treated and with such wearisome sameness, those styles have greatly fallen in public esteem within the last few years. Notwithstanding that we know that even the best preserved examples of Grecian architecture are reduced to little more than the skeletons of what they originally were, quite dismantled and shorn of their splendour, and seen, some of them, in all but total eclipse, we content ourselves with copying their *remains*, without attempting to supply those beauties which are no longer to be traced in the faded originals. Perhaps were we to set about making trial of it, we should find that a very great deal might be done with *painted glass*, even in the Grecian or Roman style. It is not to be supposed that any Pecksniff could discover *how* it ought to be done; neither could it be done by adopting Gothic patterns and Gothic character; yet it might be made to have a sufficiently expressive character of its own, by being introduced as a species of *transparent mosaic*. In such case the apertures ought, perhaps, to be double glazed, so that the painted window would show itself only as a mere panel or compartment on the face of the wall, decorated after such fashion—which would, to a certain degree, be a substitute for other polychromy, or else a suitable accompaniment to it.—But it would be a most scandalous innovation.

IV. Much of our modern Anglo-Grecian architecture is chiefly remarkable for extreme *sulkiness* of look; this, however, may be a merit, for it may be strongly characteristic of our unfortunate *climate*. And though the sun does really shine now and then in this country, perhaps about half-a dozen days in the course of the year, its brightest beams cannot dispel the gloom and sulkiness of some of our ultra-classical buildings. We have among us, more especially,

"Him, the great master of the sulky style,"

whose buildings have one and all a strange Mawworm physiognomy, no matter whether it be intended for Grecian or for Gothic.

V. At present, the new Conservative Club-house in St. James' Street does not promise to be very much better than the one in Pall Mall, either as to composition or style; or to be treated with particular gusto. It might have been thought that, coming after such an example as the Reform Club House, a certain spirit of rivalry would have stimulated the members of the Conservative to take care this second time that their building should, if possible, take precedence of the Reform in public opinion, as a finished work of architecture; yet the new Conservative certainly does not challenge comparison with the other, for the architect seems to have most carefully avoided whatever might look like borrowing an idea from Mr. Barry; though he might, allowably

enough, have taken a lesson from him in regard to general refinement of taste. As yet the building is not carried up higher than the top of the ground floor: neither is that portion finished, still enough may be made out to convince us that whatever may be the care with the upper part of the façade, there will be very little beauty below. In fact, the ground floor is not only plain, but rather bald in style, consequently, if much richness be affected elsewhere, there can be but very little general harmony of character. Although the principal floor of a building requires a higher degree of decoration than the one below it, it does not follow that the last is to have scarcely any, or that what there is may be treated as of no importance; on the contrary, well studied and careful detail are there more especially called for, as being in such situation so much more distinctly seen—in fact the only parts that are seen by those passing along on the same side of the way, for in order to have a proper view of the whole of a front and its upper part, it is necessary to look at it from the opposite side of the street. Another reason for paying particular attention to finish in those parts of a building which are nearest to the eye, is that it will be taken for granted that equal care of execution has been bestowed throughout, though the ornaments and details at a distance from the eye may be less highly wrought up—however richer and more ornamental they may be in point of design. All this is, of course, to be taken *grano salis*, because circumstances must decide when and to what extent it is desirable to treat the ground-floor or lower portion of a building as an important part of a composition.

In the case of the new "Conservative," such mode might very well have been adopted, for now, the lower part of the front will be at least very tame, if not decidedly poor, in character, yet at the same time the reverse of sober as to design, for at each end of front is a sort of loggia or recess between two Italian Doric columns, placed excessively wide apart; and one of these recesses, viz., that at the north end, has a second smaller recess within it, also between two columns, and containing the entrance door; while the south one encloses a bay-window, which is segmental on its plan. Owing to the prodigious interval between the columns, these *loggias*, or whatever else they may be called, have the appearance of being square gaps, and that, too, precisely when there ought to have been a decided expression of strength and solidity. In one respect, the building manifests neither originality nor improvement, having mean horizontal stripes after the ordinary fashion of those on the parlour floor fronts of suburban "speculation" houses, without even mouldings of any kind being substituted for rustication. To be sure, this is only matter of taste, but it would be well were such taste wholly exploded, or at any rate abandoned to speculation builders. One vast comfort is, that the façade of the British Museum will make ample amends for all other mishaps—for all our blunderings and all our failures—our National Galleries, Buckingham Palaces, Nelsonian Monuments, and all the rest of the tribe.

THE EPISCOPAL CEMETERY CHAPEL, WISBEACH.

One prevalent foible of the age is Fussiness, a sort of bustling, fidgetty, over-acted parade, mixed up with a good deal of maudlin cajolery, manifested ridiculously, and sometimes still more offensively, so that what ought to be works of charity and sober-minded piety, frequently appear, in the eyes of the sober-minded, to be acts of simpering self-laudation, ostentatious display, and almost of self worship. Charity, now-a-days—at least fashionable charity, cannot put its hands into its pocket, without a flourish of trumpets announcing to all the world its own prodigious goodness. A very remarkable instance of the kind occurred at Wisbeach, in August last, when that place presented the spectacle of a general carnival, for about a week, and kept up with great gaiety and carousing, there being a fancy Bazaar, ball, concert, picture-exhibition, and, most strange to say, a "grand display" of fire-works, also, on the occasion of laying the first stone of a small cemetery chapel! We had hoped that "fancy bazaars" and all such equivocal—or, we might say, farcical—doings in the aid of charitable or religious purposes, had gone out of fashion, at least were greatly on the decline; for we cannot help looking with great suspicion on the charity which requires to have the bait of amusement and excitement thrown out to it. To make a trading speculation of what professes to be a work either of benevolence or public spirit, to resort to such a mode of raising funds as was adopted at Wisbeach, is, to say the least of it, in particularly bad taste, a succession of festivities and holiday rejoicings being altogether out of character with the actual occasion, which would have been more appropriately celebrated by a masque of the "Dance of Death," than by feasting and fireworks. Besides being altogether unsuitable in themselves, the "performances" got up for the occasion were upon a scale so wholly out of proportion to it, that it was an affair of a mountain bringing forth a mouse. Were the edifice that has been commenced at Wisbeach intended to be such a pile of Gothic architecture as Cologne cathedral, there would have been an excuse for the extraordinary rejoicings which attended the ceremony of laying the first stone; but as its internal dimensions will not exceed 30 feet by 16, somewhat less than those of a not particularly large dining-room, the fuss made by the good people of Wisbeach does partake somewhat of farce.

What was expended one way or other without any advantage all at to the funds for the building, must have amounted to a sum that would nearly have defrayed its total cost without further contributions. The fireworks alone, as we are informed by the *Cambridge Advertiser*, which has minutely chronicled all the "small beer" of this mighty affair, cost the "worthy vicar" not less than 40 pounds; and as the same gentleman kept open house during the week, with banquetting parties of "distinguished guests" to the number of sixty in one day, and a hundred-and-thirty another, he would hardly have been a loser, had he erected the chapel at his own sole expense, and thereby have secured to himself some more permanent fame than his "pyrotechnic treat" is likely to obtain for him. Perhaps this last, by the bye, was not altogether so inconsistent as it at first appears, for it may have been intended as a sort of *pyrotechnic sermon*, symbolizing the brevity of human life, the transitoriness of all worldly splendours, glaring for a brief moment in dazzling radiance, and then bursting and vanishing altogether into extinction and darkness; thereby serving as a most impressive memento-mori!

As mere amusements, those at Wisbeach were innocent enough in themselves, but were rendered unbecoming, by being altogether at variance with the occasion, which was made to serve as a pretext for them. They may also be taken as one strong manifestation of that strange spirit now rife in society, which seizes on every opportunity as one for indulging a passion for heated excitement and mountebank display, whether it be that of Father-Matthewism, or Puseyism, or Newmania, or any other mania of the day. Still, we certainly should not have bestowed any notice on the doings at Wisbeach, or at most should have pointed to them only as a caricature of the idle and nonsensical "ceremony of laying the first stone" of a building, as it is called, were it not that there is something else connected with the building itself of more immediate interest to our readers.

Notwithstanding that the chapel itself will be a mere miniature fabric, two gentlemen are employed upon it in the capacity of designer and architect—not a Wisbeach Pecksniff and Pinch, but persons of some note in the architectural world, viz. Professor Willis and Mr. Basevi, the first of whom has furnished the design, while the other merely acts as clerk of the works. Such application of the principle of division of labour and combination of talent, may in certain cases be proper and advantageous enough—for instance, in such an extensive and complicated pile as either Windsor Castle, or the "Palace of Westminster"; but in that of so very small a building there was no occasion for it—none at least for formally avowing it. The design being his, Professor Willis might have been allowed to pass as its architect, for it would have been taken for granted that he was not the operative one, but had professional assistance of some sort or other. As far, indeed, as he is concerned, the circumstance of another

name being mentioned, is not surprizing; but it is somewhat singular that the architect of the Fitzwilliam Museum should have consented—not to lend his name to the Professor, but to allow it to be formally made known that he acts in such subordinate capacity on so trifling an occasion. It certainly amounts to a formal acknowledgment on his part that there would be nothing objectionable in occasionally deviating from the present system, and applying to amateur architects for designs, and trusting to them for all matters of imagination and taste, a professional man being employed merely to execute the ideas of the other. That such course would be wholly preposterous and unwise, we do not say; on the contrary, we are of opinion that had there been some "Professor Willis" to many of our public buildings, they would have been far more satisfactory, in point of design, than they now are—perhaps the British Museum among others. It might, therefore, be not altogether amiss, were professional men occasionally to consult non-professional opinion and taste.

In the case of the Wisbeach Chapel, these are considerations which give it more importance than it might have else had in itself, becaus the course which has been adopted seems to emanate from the Camde Society, and the authority they assume and would fain establish for themselves in all matters of *Ecclesiology*—even to the extent of pedantical, busybody interference, and dictation. We may be mistaken, but it does look in some degree as if Mr. Basevi has lent himself, perhaps unsuspectingly, to the views of the Camdenists, in the hope of securing their patronage; and what he has done may now be set up as a precedent by which others are to be noosed. If the profession once allow that Society to get upon their shoulders, they will find them quite as difficult to shake off again, as Sindbad did the accursed old man who fastened himself upon his. In regard to encouraging greater attention to the proprieties of church architecture, the Camdenists may do some good, but they are by far too bigotted and intolerant—rigid precisians, denouncing without mercy whatever does not exactly square with their fanciful, yet starched and straight-laced code of ecclesiological statutes. They appear sadly averse to recognizing as lawful any other style or mode of treating it, than such as are by them privileged: every thing else they repudiate as partaking not only of architectural, but almost of religious heresy.

As to Professor Willis, he has distinguished himself as an able and intelligent architectural antiquary, notwithstanding that Mr. Gwilt has not thought his "Remarks on the architecture of the Middle Ages," worthy of being enumerated along with other publications of that class; but of the Professor's skill or taste in design we are unable to form an opinion, for the wood-cut of the Wisbeach Chapel, given in the *Cambridge Advertiser*, is so miserably drawn, that no reliance can be placed upon it. Making the utmost allowance, however, for that, the design itself looks very queer, and as if it greatly needed touching up by Mr. Basevi, unless together with bad drawing positive mistakes have been committed.

OBSERVATIONS ON ARCHITECTS AND ARCHITECTURE.

By Henry Fulton, M.D.

No. 1.

In the present era of improvement and invention, the science of architecture is least improved and least understood. I have conversed with many persons well conversant with all the other branches of art, who on the introduction of the subject, have met it with "Oh, I know nothing of architecture." I have met architects, who acknowledged they had no professional library; and I believe they felt this as no loss, for they seemed to consider any drawing tastefully got up, and calculated to catch the eye of their employers, quite good enough: in short, want of knowledge in the employer, begets carelessness in the employed. Feeling this strongly, I ventured in 1842 to deliver a public lecture [1] on the subject, to which the architects of Dublin were invited; but they met in conclave, and decided not to countenance the attempt of a mere amateur, or even to permit their pupils to attend, alleging that it was quite improper for a physician to attempt giving a lecture on architecture. The intention of delivering a course of lectures was announced. Why has it been given up? It was declared publicly that "the highest in rank in Italy were not ashamed of being professors of an art which Vitruvius taught and Palladio adorned." Are the architects of Dublin now ashamed of Vitruvius and Palladio?

Unless we look for something better than the works of either Palladio or Vitruvius, the science of architecture will profit but little; and as contrasted with the taste displayed in the Parthenon, the Pantheon of Agrippa, or the Minster at York, should only be considered as a mere trade in building, and not as one of the fine arts: and its professors, instead of ranking with painters and sculptors, should be classed with decorators and wax-work wig-block makers.

It is to be regretted that traces of this Palladio mania are to be found in too many of our edifices in London. If Palladio had not *adorned* his buildings with coupled columns, would we have had them in the exterior of St. Paul's? If Palladio had not placed portico over portico, would Sir C. Wren have left us—not us, but feathered bipeds—an aerial entrance facing Ludgate Hill? If Palladio had not misplaced pediments, calculated only for the terminus of a gable end, over his windows, would we have them, both acute and obtuse, stuck in every possible variety, over those of the banquetting hall, and five hundred other halls and houses in London? If Palladio had not revelled in rustic quoins and rustic fronts, would we have had these receptacles of dirt and dust meet our eye so often in our streets? If Palladio had not crowned his cornices with balustrades, would we have had these caricatures of columns entering into composition *called* Grecian? If Palladio had not broken up all his buildings and all his cornices, destroying all repose, all dignity, all simplicity, would our own buildings of the present day have presented us with so many examples of the want of dignity, unity, and simplicity? But we shall not swell this catalogue of Palladian beauties, but proceed to state the grounds of objection to them.

Corporal Trim's illustration of the disadvantage of placing too many sentinels on one post, may serve us as to the first, as no architect that loved his columns would crowd too many of them together; and further, no employer who loved his purse, would consent to it. One column, well proportioned to the superincumbent weight, is better than two slight ones, and two well proportioned columns are in excess, where one would suffice. It is true the ancients slightly contracted the distance between the columns at the angles of the buildings, but the coupled columns are a caricature of this, when the eye should have uniformity instead of variety.

Secondly, a portico should be an entrance to a building: and if so, how can the one pair portico of St. Paul's be so considered, unless for a set down from an aerial machine? but it will be time enough to provide for such contingencies when the plans for the machine itself shall be matured, and in the meantime, let us recollect the point of view in which columns should appear, and not violate good taste by placing them too high, either on stilts, or by making one row of columns and its architrave support another set and accessories.

Thirdly, a pediment is a true and legitimate termination, crowning the gable of a building in its entire extent; and according to the laws of fashion, a hat is a proper crown for a man's head: but it by no means follows that a hat is a suitable ornament (however diminished) for his shoulder, his eye-brow, or his upper lip. neither should the hat be of such dimensions as only to cover the centre third of the caput. But that great authority, Palladio, turned these window pediments to more account than his followers now do, for he placed a colossal figure in a half-sliding, half-reclining, though perilous posture, on each side, like two sentinels on one post. Improve on this, I beseech you, ye Palladians, and place one figure astride your door and window pediments, and turn them forthwith into hobby horses. If Mr. Barry had left out of the design for the Reform Club House those miserable window pediments and the rustic quoins, that building

[1] See lecture in *Journal*, Vol. V., p. 78.

would have added to his fame. If these pediments were to serve any useful purpose, they ought to have been placed over every window, and not those of the first floor alone; and if intended only for ornament, (?) all should have been thus ornamented. As representations of military cocked hats, they might have been selected by the more warlike clubs; but mere civilians have no right to such emblems.

Fourthly, besides rustic quoins and rustic fronts, we have the thing carried out still further; I do not know what name it rejoices in, but it may be seen on Burlington House and the Town Hall at Birmingham: this is intended, no doubt, to give us some idea of rocks. I do not know that Palladio is accountable for this latter; I rather believe it had its origin in the times of cutting yew trees into figures of things animate and inanimate. It may be very proper that a house should be built on a rock, but that a tree should represent a man, or a house a rock, is not so evident: the exterior of an edifice should represent one whole, not made up with a show of patches, but as a composition, stable and secure, concealing, not thus exposing, the smallness of the materials, by the introduction of rustic work, either as quoins or fronts. As receptacles of dirt and moisture, such work is unsuited to our climate, and can only be of use to the builder by swelling his bill of charges.

Fifthly, it is difficult to say why modern architects crown their cornices in almost every instance with balustrades. Surely the advocates of this practice do not think—if indeed they think at all about the matter, that a pigmy column can harmonize in a composition with columns of due proportion, or that a cornice is at all ornamented by this tasteless expenditure; but in truth the necessity for balusters, can only occur when the cornice itself is meagre, and does not sufficiently mask the roof.

Sixthly, broken lines and cornices are the most glaring faults of modern architecture. The only defence of the practice which I have heard given is, *that it relieves the eye!* Relieves the eye from what? The eye can take in a straight line easier than a broken one. When an officer wishes to show off his regiment to advantage, does he not dress his line? I wish our would-be Grecian architects would observe the same rule in dressing theirs. In order to observe the contrast between broken and unbroken lines, let us take a model of the Parthenon, and break up its cornices, &c., according to modern practice, and then look at the result. No—in the Greek style, and all those which attempt to approach it, simplicity must exist where dignity is desired, and this simplicity is not inconsistent with the highest state of finish, and with ornament, so rich, as to be beyond our ability to produce any thing similar, as for instance, the marbles of the Parthenon; but all ornaments should, as they did, harmonize with the edifice.

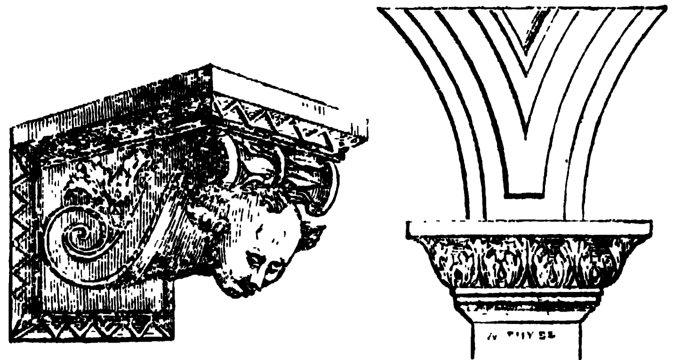
I believe I have seen all the urban edifices of Palladio; as to the suburban, I did not see many of them, nor did I think they were worth going out of the way to see, as I could not observe a single beauty in any of those I did see. Did Palladio draw on those works of the ancients, which he measured and delineated? Oh, yes, he did, just as Sir Fretful Plaigery, took the worst parts of the works of others; and yet these appropriations, when glaced beside his own productions, seemed like patches of silk embroidery on a fleecy-hosiery ground!

As in the lecture before referred to, most of the public buildings in Dublin are criticised (but not more severely than they deserve) I would wish to do justice to one erection made since the delivery of the lecture. And in truth, the breast wall carrying out the improvements in Nassau Street in that city, is every thing that could be desired, and although of humble pretensions, yet calculated to give more pleasure than a view of any of our ornate buildings. A plain straight breast wall (1800 feet in length) of well-tooled granite surmounted with a plain and suitable moulded coping on which the rail is placed. No breaks, no rustics, *nothing in the cant of false taste to relieve the eye:* no, the eye needs it not, for all is repose and harmony. I wish I could say as much of the railing, but perhaps it would be too much to expect perfection in it also, and as a contrast it is broken up by of 48 trumpery pilasters, on which the arms of the College are introduced 94, and the name of the iron founder 47 times. From its locality we may say that this ostentatious display of the name of the *man of iron*, is the foundation of the bad taste of the superstructure. If the railing and the ornate stable at the east end of the screen corresponded with the chasteness and simplicity which characterise the breast wall, the entire might be hailed as the harbinger of improved taste.

Mr. Gwilt, who admires Palladio more than I do, will doubtless cry havoc, and let slip his pen against the attempt of a mere amateur to write on these subjects; but I am ready to stand up for my order, and ask who designed York, and the many other Gothic cathedrals of the same class and date? were *they* professional architects or mere amateurs? Was William of Wykeham an architect? and yet have professional architects since the age of the Parthenon and the Pantheon, produced any thing to equal them? St. Peter's itself, the pride and glory of modern Rome, is perhaps twice as large and cost ten times the amount required for York, and although, from its vastness, it is beautiful, yet it cannot stand a comparison with York or the Parthenon, or even the Pantheon of Agrippa.

But the amateur of the middle ages found the state of architecture degraded and debased; fortunately for posterity they knew nothing of Vitruvius, or of Grecian art as handed down by the Roman school, else, like Palladio, they might have attempted its restoration, and, like him, have failed. No! from the confusion into which the art had fallen after the age of Dioclesian, they did not attempt to rescue it, but out of this chaos created a new style, which, in after times, architects in derision called Gothic. Perhaps these amateurs may not have left us any thing equal, certainly nothing which surpasses, Grecian art, still they have undoubtedly left, at an immeasurable distance, all their revilers of the Palladio-Vitruvian school.

After the practice of the art had passed from Grecian into Roman hands, the decline was gradual but complete, and the age of Dioclesian exhibits its total decadence. That much, both of the Palladian or Vandal and Gothic architecture, arose out of the Dioclesian, is evident. In the ruins at Spalatro we have the swelled frieze, arches raised on slender columns, these latter supported by consols, which are ornamented with representations of the human face, just as we see in the Gothic, as the following, taken from Adam's work on Spalatro, plate xvi, will show.

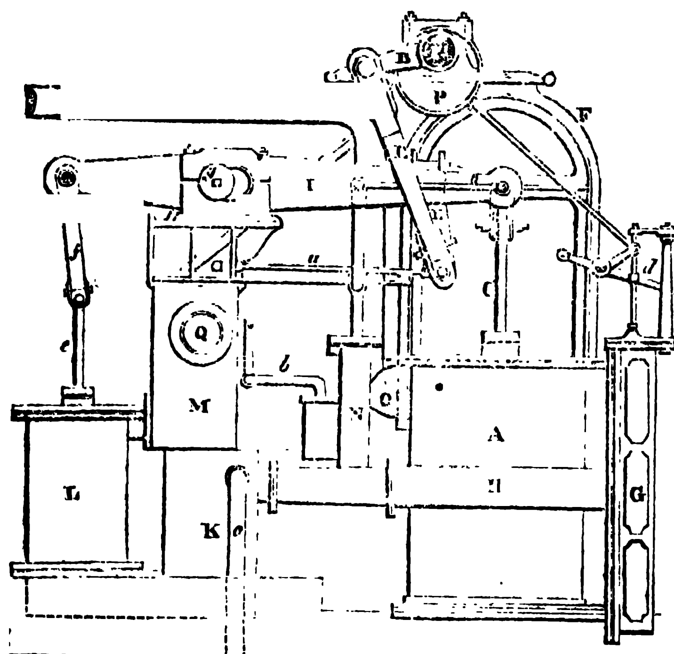


It is remarkable that the zig zag moulding on the consol is to be found on many of the early specimens of Gothic; and also, as pointed out to me by my friend Mr. Petre, on some of the Irish round towers. The moulding on the archivolt of the other figure will also suggest a strong resemblance to the deep doorways of the Gothic.

Let not the profession imagine that I want to transfer the working of the art from their hands into that of amateurs. Architecture is a profession the details of which require much experience and study, and few amateurs will be found capable of working out these details; but the same judgment which is necessary to enable a purchaser to feel the merits of a painting or a statue, is absolutely necessary in the science of architecture; and unless that taste exist, it is in vain to expect any thing like improvement in the designs for either our

public or private edifices. But it is to amateurs, and not to the profession, that a more correct taste is to be looked for, and although almost every one feels the defects of what has been done in our times yet until men of intellect and mind (amateurs though they be) shall seriously turn their attention to the subject, it is in vain to expect any improvement.

MARINE DIRECT ACTION ENGINES OF THE "LORD YARBOROUGH."



A, cylinder and casing; B, the cranks; C, piston rod; D, hanging link; E, connecting rod; F, main frame; G, side valve case; H, exhaustion pipe; I, main beam; K, condenser; L, air pump; M, hot water cistern; N, feed pump; O, O, steam pipes; P, eccentric; Q, discharge pipe; *a*, *a*, radius rods; *b*, feed pipe; *c*, injection pipe; *d*, starting handle; *e*, air pump rod; *f*, connecting link to beam; *g*, roller to centre of beam.

Wishing to make this *Journal* a chronicle of present improvements in marine engineering as well as a record of the past, we this month publish a descriptive account of a pair of "direct action" engines, manufactured as far back as 1825, and erected in a vessel called the *Lord Yarborough*, and now, and from that date, plying between Portsmouth and the Isle of Wight, working in a very satisfactory manner.

The designer, and we may say, constructor, of these engines, is Mr. William Yates, then of the Commercial Road, but now having charge of the steam machinery at Messrs. Currie's distillery at Bromley, near London; and taking into consideration the date of their introduction, will be found to contain considerable merit.

In the discussion, in this *Journal*, on beam and direct action engines, the existence of the *Yarborough's* engines does not appear to have been known, otherwise their similarity with the *Gorgon* engines no doubt would have been noticed.

In 1821, a caveat was lodged by Mr. Yates, and a patent would have been obtained for this construction of engine, but for various reasons, that it is unnecessary to enter upon here. It appears that in 1825 the Portsmouth and Ryde Steam Packet Company gave Mr. Yates an order for a pair of these engines of 18 H.P., and they were made as represented in the annexed engraving. The cylinders are 24 in. diameter and 2 ft. 8 in. stroke, the radius of the crank equalling 12½ in. The power, at 175 ft. per minute, equals 16¾ H.P. each cylinder. Paddle wheels 11 ft. diameter, and length of paddle equalling 5 ft. Beam of vessel 13 ft.; draft of water 5 ft. 9 in.; immersed section equals 33 ft.

This kind of engine certainly possesses many advantages; among others may be mentioned, small space occupied, light construction, and principally, their position in the vessel, near to the centre transversely, and bearing chiefly on the kelson or strongest part of the ship, the most important part of the machinery being below the water line, all which points were duly considered by Mr. Yates 22 years since.

Mr. Yates also furnished drawings of a *three cylinder* engine, designed in 1821, at the request of Captain Borne, of the *London Engineer* steam vessel, to increase her power from 70 H.P. to 105 H.P., without requiring additional space, but it was rejected on account of the shortness of the connecting rod; this arrangement might be applied to large powers with great effect. On the whole, we cannot but highly applaud Mr. Yates for his ingenuity, and see that the opinions and views he entertained 20 years since, have been lately adopted by others.

ON STREET MAINS OF CAST IRON, FOR GAS AND WATER CONVEYANCE.

The present unprecedented low price of iron offers an opportunity for the extension of gas and water works, which it is surprising has not been urged with avidity by such places as are yet destitute of the luxury of either; and at the same time, considering that the furthering of such works is one of the occupations of the civil engineer, I am induced to send you a paper on the subject of street mains, being the collection and collation of examples which have fallen under my notice during an attention of upwards of one third of the useful portion of human life. First as to the direction of the pipes or mains. They should be laid in as straight a course as possible, and their inclination should be uniform and not to exceed one in a hundred, if it could be avoided by any possibility; and where descending mains meet and form an angle, syphon pipes or receivers should be placed to collect deposition of mud, &c. The names main and sub-main are given to leading pipes from 4 in. to 18 in. diameter, and for smaller, the term service pipes is used. Pipes are of two descriptions, socket and flanched, a table of each description is given; in measuring socket pipes, the socket is excluded from the measurement. Pipes above 4 in. are all cast 9 ft. long, and under 4 in. down to 1½ in. are usually 6 ft. long, and 1½ in. are 4½ ft. long. The pipes are generally delivered at the works, and then previously to being used, are proved by hydraulic pressure equal to a column of water 250 ft. high; and in warm weather it is desirable in proving pipes to use warm water. Practice will enable a skilful prover to tell by the ring of a pipe, from a tap with a hammer, whether it is faulty, either from being cracked, or deficiency in thickness. It is usual for pipes all above, say, 4 in., to be charged by the ton, and for the smaller, a certain price per yard, varying as the size, the socket being excluded from the measure; the price for straight pipes in 1834, was 150*s*. per ton, the bends and branches, or particular pipes, being 40*s*. additional, and the boring of the fire plugs also being extra, at, say, 18*d*. each. In 1832, from the same note book, I find the cost of straight pipes was 188*s*.

per ton, the difference of 12*s*. per ton being altogether due from the facility of delivery; about the same time also, I have the price per ton 135*s*., and the extra for particular pipes, 55*s*. With respect to the cost of digging trenches, they will vary as the depth; and I know they have been done as follows, 3 ft., 4 ft., and 5 ft. respectively, 2¾*d*., 3½*d*., and 4½*d*. per lineal yard; also, in regard to paving, ramming, and removing surplus earth; and finding stone where deficient, the price will vary with the nature of the material, as Macadamised road, square paving, and random paving, which I have done at per lineal yard, as follows, 3*d*., 5¼*d*., and 7¼*d*. The depth below the surface of the ground should not be less than 18 inches, to guard against frost and casual disturbance of the street by repair. The contractor for the work or pipe-layer generally finds his own tools and lights, the company being at the expense of repairing damage to lead pipes, repair of roads, and removal of rubbish. I should rather say that four contracts are usual, one for the pipes per ton delivered, another for the payement, a third for the trenches, and fourth for pipe-laying. Joints of the pipes are usually made with molten lead; but other materials are also used for economy, viz., wooden wedges, (see *Journal*, Vol. I, p. 242.) also wood with iron wedges interspersed; a mixture of cast iron borings with sal-ammoniac is sometimes used for socket pipes. For flanched pipes a wease or washer of yarn or sheet lead, smeared with red or white lead, is used, and the pipes being cast with a flanch at each end and screw bolts inserted, and when screwed tight the joint is complete.

In the appendix I have given a table showing the weight of flanched pipes, and the number of holes in the flanch. In the second table is the weight and thickness of socket pipes with the cost of the pipes per yard delivered, and the total cost per yard including pipes and laying, and in the third is a table of detail for 3, 4, 5, 6, and 15 inch pipes, from actual execution, and from which the cost of the pipes in the 2nd table has been computed. It must be borne in mind, that the weight of pipes is also applicable to columns or pillars. In that very useful work *Laxton's Builders' Price Book* several tables are given of pipes, and one in particular gives the usual lengths and different diameters and weights of lead service pipes.

It has been previously noticed that the boring of fire plugs and particular pipes are charged extra, but the most costly appendages yet remain to be noticed, viz., slide cocks with brass and copper facings, which will cost 21*s*. per inch of the pipe's diameter for all sizes of pipe, and for the smaller size as high as 35*s*. per inch. The when, why, and wherefore, of the introduction of these, as also the size of the mains and their gradual diminution to suit particular localities, must be left to the hydraulic engineer, but, as a general question, I may be allowed to state from 14 in. to 15 in. diameter of pipe will be sufficient to supply a population of from 70 to 100,000.

The subject of the flow of water through pipes of different lengths, both horizontal and vertical, has occupied a good deal of your pages, and a paper was read to the Institute of Civil Engineers by W. A. Provis, Esq., in the session of 1838, and reported in the *Journal*, Vol. I., p. 383, containing the following deductions. "In level pipes the quantity of water discharged is nearly in the inverse ratio of the square root of the length; but the departure from this rule is greatest in the shortest lengths and greatest heads. In inclined pipes, the increased discharge is greater in the long than in the short pipes. The increased discharge for an increased head is nearly in the same proportion through the long and short lengths." The above extract is the result of several experiments forming a direct appeal to nature for facts. At page 407, vol. 5, of the Journal, commences your review of Mr. Shuttleworth's Patent Hydraulic Railway, which has led to your pages being so fully occupied, perhaps unprofitably, with the subject of the flow of water down vertical pipes, which has also been continued by yourself, and a correspondent T. F—x, in Vol. 6, pages 37, 123, and page 149, by I. T—x, which as connected with this subject, I have noted for future reference. The following rules as to the quantity and velocity of issuing water, I have collected from various sources, the first was given me by a friend who is an hydraulic engineer, viz. formula for calculating the quantity and velocity of issuing water. Let h be the head of water in feet, d, diameter in inches, l, length of pipe in feet:

$$15\sqrt{\frac{h\,d}{l+5\,d}} = \text{velocity};$$

$$30\,d^{2}\sqrt{\frac{h\,d}{l+5\,d}} = \text{gallons discharged per minute.}$$

To find the weight and quantity of water in full pipes, square the diameter in inches, which will give the weight in pounds in a yard of pipe; and if one figure be cut off on the right hand, it will give the number of gallons.

Quantity of Water discharged by Iron Pipes.

Multiply twice the fall in inches per mile by one-fourth of pipe's diameter in inches; extract the square root; take $\frac{10}{11}$ of root for velocity in inches per second. Divide by 12 for feet per second. This is the velocity that will be maintained if the pipe be fully supplied. For a head of water the velocity will be increased as the square root of the height.

The manner of laying, direction, usual size and dimensions, depth below surface and cost of trenches, and making good pavements, have been alluded to, as also the manner of proving; but the description of metal and mode of casting has not been noticed. Many parties are content with casting on a sloping bench, others insist on perpendicular casting, with a head of metal above the top of the pipe; and as regards the metal, it is now commonly run direct from the blast furnace, and not from the cupola of little foundries as was formerly the case. In conclusion: I think this a rambling collection, but trust the tables will be a sufficient apology, as also the wish of contributing, in however small a degree, to promote the cleanliness, and consequently the health, of the poorer, although not less useful, portion of the community.

St. Ann's, Newcastle-upon-Tyne. O. T.

APPENDIX.

Detail Cost of laying Pipes.

3 *in. Pipes, cost of* 9 *ft. length.*

		s.	d.
6 lb. of lead in joints at 14*s*.		0	9
4 oz. of yarn or gaskin, 5*d*. per lb.		0	1¼
Labour in laying		0	2
Excavation, refilling and paving		2	6
Labour per yard,	1*s*. 2*d*.	3	6¼
Metal per yard,	2*s*. 11*d*.	8	9
Total cost	4*s*. 1*d*.	12	3¼

4 *in. Pipes.*

		s.	d.
8 lb. of lead in joints, at 14*s*.		1	0
5 oz. of yarn		0	1½
Labour in laying		0	2½
Excavation, filling and paving		2	6
Labour per yard,	1*s*. 3½*d*.	3	10
Metal ditto	4*s*. 1*d*.	12	3
Total cost	5*s*. 4½*d*.	16	1

5 *in. Pipes.*

		s.	d.
10 lb. of lead in joints, at 14*s*.		1	3
6 oz. of yarn		0	2
Labour in laying		0	3
Excavation, filling and paving		2	6
Labour per yard,	1*s*. 4½*d*.	4	2
Metal per yard,	5*s*. 9*d*.	17	3
Total cost per yard,	7*s*. 1½*d*.	21	5

6 in. Pipes.

12 lb. of lead in joints, at 1s. 2d.	1	6
¼ lb. of yarn	0	2½
1 yarner, 1 clayer and rammer, 1 pelter up, 3s. 6d. each, two labourers, 2s. 6d., 1 fireboy to 55 joints	0	3¾
Excavation per length	1	0
Filling and Paving ditto	1	6
Labour per yard, 1s. 6d.	4	6¼
Metal per yard, 6s. 9d.	20	3
Total cost per yard, 8s. 3d.	24	9¼

15 in. Pipes.

32 lb. of lead		3	10
Excavation per length		1	10½
Filling and paving ditto		2	9
2 lb. of gaskin		0	10
Labour per yard, 3s. 8d.		1	9
		11	0½
Metal per yard, 24s. 2d.	3	12	5½
Total cost per yard, 27s. 10d.	4	3	6

TABLE OF WEIGHT AND DIMENSIONS OF FLANCHED PIPES.

Diameter of Bore.	Thickness.	Diameter of Flanch.	Number of Bolt Holes.	Size of Holes.	Diameter of Circle thro' Holes.	Thickness of Flanch.	Weight of a 9 ft. Length. cwt.	qr.	lb.
2	⅜	6½	4	⅝	4⅝	9/16	0	3	0
3	⅜	7½	4	⅝	6	⅝	1	0	3
4	½	9½	4	¾	7¼	¾	1	3	5
5	½	10½	4	¾	8¼	⅞	2	1	12
6	⅝	12	4	⅞	10	⅞	3	2	1
7	⅝	14	6	⅞	11¾	1	4	3	17
8	⅝	15	6	1	12¾	1	5	2	9
9	¾	16½	6	1	14¼	1 1/16	6	1	12
10	¾	17½	6	1	15½	1⅛	7	0	0
11	⅞	19	6	1	16¾	1 3/16	8	3	24
12	⅞	20	6	1⅛	17¾	1¼	9	3	5
13	⅞	21	6	1⅛	18¾	1¼	10	2	0
14	⅞	22	8	1⅛	19¾	1¼	11	0	26
15	⅞	23	8	1⅛	20¾	1¼	12	0	25
16	⅞	24½	8	1¼	22	1 5/16	12	3	8
17	⅞	25½	8	1¼	23	1 5/16	13	2	17
18	1	26½	8	1¼	24	1⅜	16	1	15
19	1	28	8	1⅜	25	1⅜	17	2	13
20	1	29	8	1⅜	26	1⅜	18	0	26
24	1	33	10	1⅜	30	1⅜			

Cost of laying pipes, including digging, filling in, and lead for joints, but exclusive of pipes and carting superfluous earth, and making good roads, *per yard.*

Inch.	s.	d.	Inc	d.
2	1	0	8	0
2½	1	1	9	6
3	1	2	10	0
4	1	3	12	6
5	1	4½	15	0
6	1	6	18	0
7	1	9	24	0

	d.
Relaying, paving, or making good roads, *per yard*	9
Boxes for plugs, *each*	0
Ditto with flaps, *each*	0
Spiggots, *each*	6
Boring Plugs, *each*	0

ELECTRO-GALVANIC BLASTING.

SIR—Having read with much interest, in your *Journal* for August, the account of the various applications of the electric fluid to the useful arts, by Mr. Alexander Bain, I beg to communicate to you another application of the conducting power of water, which, with the approval of Major-General Pasley, I have lately adopted in firing sub-marine charges over the wreck of the "Royal George," at Spithead, and which the General and myself both consider a great improvement on the mode hitherto practised.

My attention had been for some time led to this subject, in carrying on some experiments in June and July last, on the relative power of different lengths of wire conductors in use over the wreck, for transmitting the electric fluid. These conductors consist of two stout copper wires, separated by an 1½ inch rope; the wires are carefully insulated and paid over with tape, yarn, and waterproof composition: the rope is saturated with the same composition, being immersed in it while boiling, and yarn is then bound round the whole with a second coat of the composition over it.

The apparatus used for the experiments was the voltameter, consisting of a glass vessel with inverted tubes, two pieces of platinum wire were fixed into the sides of the vessel, and bent at right angles, to enter the tubes; on connecting the two ends of the conducting wires at one extremity, placing a voltaic battery at the other, and the voltameter within the circuit, the water in it was rapidly decomposed, gas was emitted and passed into the tubes, which being graduated with a scale divided to tenths of inches, showed the relative power of each length of the wire conductors by the quantity of gas delivered in a certain time.

I was, however, surprised to find that decomposition of water ensued, even when the ends of the wires furthest from the battery were disconnected, and it soon became evident, that as these wires had been frequently used for firing charges at a depth of 13 fathoms under water, a certain degree of moisture must have been forced in by the great pressure at that depth through the exterior coating, notwithstanding the precautions used to make it and the wires waterproof, and thus the electric fluid must have been led from one wire to the other, causing action in the voltameter; this became still more apparent on applying the voltameter and battery to a length of wire conductor which had never been under water, as unless the ends of the wires were connected, there was no gas emitted. There was another convincing proof of the power of water as a conductor, though it in some measure frustrated the object of my first experiments; but prosecuting the subject still further, I have since been enabled to turn this power to account, by using the water as a conductor in conjunction with a single wire for firing charges, which are daily required over the wreck.

The method of doing this will now be stated.

From Mr. Bain's experiments as well as my own, it appeared that using water as a conductor in conjunction with a single wire, a certain metallic surface must be present at each extremity of the wire, to ensure the transmission of a sufficiently powerful current of electricity. In the case of sub-marine explosions, it would therefore be necessary to have one surface of metal at the bottom of the sea, and another at the top, the depth of water forming the conductor between them, and as the greater part of the charges used at Spithead are common oil cans of tin, (a good conducting metal,) varying from two to five gallons, it occurred to me to make use of the tin can as the metal required at the bottom, and at the surface of the water to use plates of zinc.

Before lowering the charge to the bottom, the single wire is connected to one of the priming or short wires inserted in the bursting tube of the charge, and the other priming wire is turned down on the tin and co[illegible]ed with it. The charge is taken down by a diver, who pla[illegible] after he has come up, the zinc plates are immersed, (I f[illegible]eriment, that three plates of 10 in. by 7 in. were required,) connected by copper wire passed through a hole in the top of

each.) The end of the single wire above water, and that of the short length attached to the zinc plates, are led to a battery, which for firing charges in 13 fathoms water, should have a power equivalent to 6 cylinders of Daniell's battery; this I found to be the minimum: on completing the circuit, the charge is fired by the transmission of the electric fluid down the single wire, igniting the piece of fine platinum fixed across the priming wires within the bursting powder, and returning by the water, which over the wreck of the "Royal George," completes a portion of the circuit equalling 80 feet.

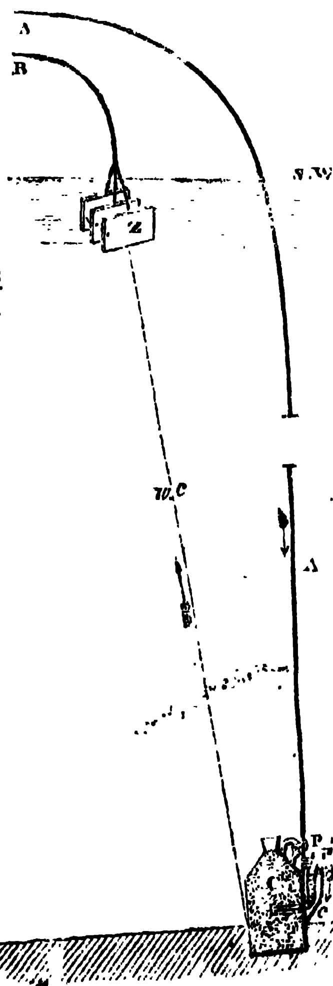
This method has now been so frequently tried and without a single failure, that it may be considered as certain and secure, and I consider it superior to that of the double wires, on account of the greater liability of the latter to break, or to be brought improperly in contact, by the shrinking and contraction of the rope after imbibing moisture; the saving of wire, is also a great object, and the single wire may be conveniently coiled on a common log reel, and held in the hand while being passed over the side of a vessel when used on a wreck.

This system may be used for charges contained in vessels of tin, iron, copper, or any other conducting metal; but when wooden casks are used, it will be necessary to attach a certain surface of metal to the cask.

I annex a sketch of the mode of connecting the single wire with the priming wires, &c.

I remain, Sir,
Your very obedient servant,
G. R. Hutchinson,
Lieutenant Royal Engineers.

Portsmouth, 10th September, 1843.



Reference.

A & B, two single insulated wires; the ends are led to the poles of a voltaic battery in a boat or lighter.
C, 3 zinc plates, 10 in. by 7 in.

A, a single insulated wire conducter.
B, a single wire.
The ends of the two wires, A & B are led to the poles of a voltaic battery in a boat or lighter.
Z, 3 zinc plates, each 10 in. by 7 in.
C, 5 gallon tin can, holding about 51 lb. of powder.
P P′, priming wires of bursting charge.
c, point of contact of priming wire P′ with surface of tin can.
w c, water conducter, 80 feet.
S. W. surface of water, 13½ fathoms above the bottom.

MUSEUM OF THE HERMITAGE, ST. PETERSBURG.

On it being first of all rumoured that Klenze had been commissioned by the Emperor Nicholas to prepare designs for a Museum at St. Petersburg, the natural supposition was, that the building was to be an entirely new and distinct one, as was the case with the Glyptothek, and the Pinakothek at Munich, the reputation of which most probably led to the architect's being employed by the Russian sovereign. It now turns out, however, that the structure will not add to the number of the architectural monuments of St. Petersburg, as it is only a re-building and extension of the Hermitage Palace, in which the "Raffaello Gallery," so called from its being a fac-simile imitation of the Loggie of the Vatican, is retained. Still, if description may be trusted, it is very greatly superior to what has been removed to make way for it; and though only an appendage to the Imperial Palace, it is in itself much larger than many palaces, the general plan forming a parallelogram of 520 by 380 ft., English measure, which is not very far short of the area of the whole of the quadrangle and buildings of the upper ward of Windsor Castle. The largest of the inner courts is 215 by 130 feet: the general height of the façade 74 ft., and that of the pavilions at the angles, 106 ft. In regard to the character of its details, the style of design is Greek, and it would seem the design itself is in some respects similar to the architect's idea for the Pantechnikon, at Athens, published in his "Entwurfe." Of the actual composition, however, it is impossible to speak from the verbal description given of it; for let the last be ever so correct as far as it goes, so many circumstances indispensably requisite to be understood, are passed over in it, that it is more tantalizing than satisfactory, leaving altogether doubtful some very material points. The *socle*, which is of reddish granite, is 11 feet high, and must therefore be of colossal proportions, and produce a most imposing effect, if it be really what the term applied to it imports—a solid substructure, in appearance at least, without windows of any sort. Nothing being said to the contrary, we are left to suppose that such is really the case; but it would have been far more satisfactory to have been distinctly assured of it, since it makes a most prodigious difference indeed whether it be so or not. Colossal must also be the effect of a mass, nearly the entire height of the Reform Club House, but with only two ranges of windows, reared on such a basement. This part of the structure is of greyish stone, with some intermixture of reddish granite for the details, yet to what extent the latter is applied is not said; hardly at all, we should think, can it have been employed for any of the more delicate and enriched parts, and enrichment does not appear to have been at all spared, for we are told of arabesque panels, sculptured friezes, statues, some supported on consoles, others within niches, hermes-pillars, &c. &c. In short, the description makes magnificent promise to the ear; but whether the structure itself would keep such promise to the eye, is what we will not pledge for. Description is equally favourable to the interior, but equally perplexing also, being by far too indefinite; a vast deal of magnificence is spoken of—variegated marble columns, inlaid pavements of Grecian design, and other matters of that kind, but it is all shapeless. Almost the only part which we can figure to ourselves at all intelligibly is the grand staircase, 130 ft. long, by 50 in breadth, with its twenty marble Corinthian columns, and three successive flights of marble steps (22 feet wide), ascending in a direct line. At any rate, in such a staircase there must be an air of extraordinary pomp. The rooms on the lower floor are intended for the reception of sculpture, vases, and miscellaneous antiquities; those above for a picture-gallery, distributed into a series of rooms, some very spacious, and lighted from above, as in the Munich Pinakothek, for larger pictures; others as cabinets, for smaller pictures, besides various loggies and corridors. The contents of the museum will be so arranged, that the apartments will have more the air of being decorated with them, as in a private palace, than of being the exhibition-rooms of a public museum, which sometimes give the idea of a bazaar, at others, of a charnel-house of art, stored with works, immortal, perhaps, in fame, but perishable, and even perished; interesting, but utterly illegible inscriptions, limbless statues, featureless busts, and pictures touched and retouched by time, till they have become only so many grim blackened canvasses, and melancholy *memento-mori's*. Although the building was not begun until the spring of 1842, the Museum of the Hermitage is expected to be completed by the end of the present summer, notwithstanding its great extent and the prodigious solidity of its constructions. In some places such an edifice would have been the work of a quarter of a century.—*Art Union.*

FALL OF THE BELFRY OF VALENCIENNES AND TRIAL OF THE ARCHITECT.

STRANGE as this latter may sound in the ears of an English architect, it is not less strange than true, that trials of professional men in France for homicide, produced by negligence or ignorance, are by no means of rare occurrence. It will be remembered that on occasion of the accident and great loss of life some time since on the Versailles Railway, an engineer and, if we mistake not, several other persons were placed upon their trial and found guilty of homicide.

In the case which follows, the architect charged with the repairs of the tower, was adjudged guilty by the local tribunal, and with a strange mockery of justice, was condemned to expiate the crime of homicide, by paying the trifling fine of 100 francs. The *Cour Royale*, however, before which the cause was afterwards tried on appeal, reversed this decision and acquitted the architect. The following particulars respecting the destruction of the tower and the subsequent trials have been gleaned from the *Gazette des Tribunaux*, and although the description of the building itself is very meagre, yet the account will show to our readers the kind of responsibility which attaches to professional men in France for the failure of their works. It is probable that in point of law the circumstances under which an architect becomes responsible, as described by the prisoner's own advocate, will equally apply in this country.

Many cities in the north of France possess those ancient towers called *belfries*, which are monuments raised in the 12th and 13th centuries, since which time they have stood like huge sentries watching over the public safety and the liberty of the inhabitants. In 1237 the generosity of Jane of Flanders endowed the city of Valenciennes with land for the site of a belfry, and in the interval from 1250 to 1260 the edifice was completed. Had this belfry of Queen Jane been more respected by man than by the hand of time, it might still have been standing. Such was not to be its fate however, for in 1762 under the provostship of M. de Pujol, it was subjected to the unhappy devices of some architect who imposed upon the old tower a roof of a new construction formed by a kind of *petit dôme* ornamented with vases in the true Pompadour style, presenting a most ridiculous contrast to the severe architecture of the middle ages, but not content with this profanation, the architect erected on the top of the tower 26 enormous stone consoles weighing nearly a million and a half of pounds, which immense weight so deranged the stability of the structure as to throw it out of the plumb line, and open fissures between the courses of stones large enough to admit the penetration of water. Thus the old belfry, which had gloriously withstood the cannon balls of 1793 and 1815, was found in 1837 to be labouring under serious infirmities.

At this time the Sieur Pétiau, who had recently quitted the School of Fine Arts at Paris, where he had acquired the most honourable distinctions, was recalled into the arrondissement which had given him birth in the capacity of architect to the city of Valenciennes.

The dilapidated state of the old belfry, its rents and crevices, the battered buttresses and loose stones, which occasionally threatened the destruction of passers by, could not escape his attention. In special reports of the 22nd July, 1837, and 3rd February 1838, he pointed out the urgent necessity for reparation, and proposed at the same time a plan for extending the base of the edifice upon the rock which served for its foundation, for encasing parts of the old and decayed masonry, and for tying the whole together in a strong and substantial manner.

This plan was not acted upon by the municipal council. Another architect was consulted, who merely advised the underpinning and reparation of the counterforts. M. Visconti, an eminent architect from the capital, expressed himself in 1841 to the same effect. A design for effecting this work was then required from the architect Pétiau, who accordingly transmitted one to the committee of the municipal council. This design, after a delay of 4 years, was at length decided upon, and received the approval of the commission of buildings for the department of the north.

The works of repair were commenced in October 1842 and were vigorously prosecuted till January 1843. The inclemency of the season then caused a suspension till the beginning of March, and in April, soon after their recommencement, one of the counterforts was observed to be rent by a large crevice. The tie-bars, to which the architect resorted, could not stop the progress of this crevice, the falling of stones continued to increase, and by the 6th of April a general alarm had spread through the city. The architect Pétiau had still faith in the solidity of the mass, and in this he was confirmed by the opinion of the Parisian architect, who had reported in 1841, "that there was nothing alarming in the state of the structure." The mayor personally visited the tower on the 6th of April, and requested the architect to furnish him with a report in writing, which was remitted to him in the evening of the same day.

In this report the architect pointed out the various accidents which had occurred since the commencement of the works, and in reference to the danger of passing in the neighbourhood of the town, expresses himself in the following terms: "all human prudence cannot prevent occasional masses, of various sizes and in various stages of decay, from detaching themselves and bringing down in their fall sounder parts of the masonry, to the serious risk of the public safety. I think, then, that every precaution should be taken by the administration to avert the danger. At the same time, although accidents are to be feared from the fall of loose stones, I firmly believe that the mass is solid, and that there is more danger in the counterforts than in the walls."

Throughout the 7th of April the symptoms increased, and during nine successive hours M. Pétiau was personally engaged in superintending the works and in hastening the evacuation of the neighbouring houses. At a quarter before 4 o'clock he was still within the tower, examining all the symptoms of ruin which it presented, and was not able up to that time to detect any immediate danger. Scarcely however, had he quitted the place, when several loud cracks were heard, and the whole tower fell bodily over, while a huge cloud of dust expanded in every direction, giving to view, as it slowly cleared away, a scene of destruction impossible to describe. The once lofty tower was now reduced to a stunted irregular pile, varying from 3 to 10 feet in height. Many of the neighbouring houses were seriously injured by the fall, and several dead and wounded victims were buried beneath a mountain of ruins. One unfortunate man was precipitated from the top of the tower, which was 240 feet in height, several persons who were passing were also killed, as well as some who were left in the adjoining houses.

This frightful catastrophe, the occasion of so much misery both public and domestic, could not escape the notice of justice, and accordingly the *procureur general* was speedily on the spot. An inquiry was instituted and the architect who had been directing the work became the subject of judicial proceedings. A commission of architects appointed to examine into the occurrence, pointed out several particulars in which the city architect had acted on his own responsibility, and enumerated various precautions which he should have taken. The greater part of these criticisms however failed to have any effect in consequence of the contradictory evidence which was afterwards adduced.

Notwithstanding this, the Tribunal of Valenciennes, in its judgment of the 12th August, although admitting in favour of the accused several extenuating circumstances, such as the activity he had displayed, the care with which he had conducted his operations and the inspection which he had made at the peril of his own life only half an hour before the fatal occurrence, yet adjudged him guilty of homicide through imprudence, and condemned him to pay a fine of 100 francs. They imputed to him the fault of not having sufficiently announced the dangerous state [illegible] structure, although, according to the opinion of other architects, this danger was sufficiently obvious.

The affair has since been tried before the *Cour Royale*, in consequence of an appeal from the inferior tribunal. On this occasion the accused was defended by M. Hur, who made an able speech in his behalf.

"The arts themselves," said the advocate, "bring at one time great rewards to their professors, and at another great punishments. At the end of some perilous enterprises the architect has sometimes to lose all the palm of victory and the chaplet woven by honourable success, while not unfrequently an unhappy failure overwhelms him with shame, and hurls him mercilessly down from the precipice of fame. Mark with what sobriety and caution, therefore, a vindictive public should descend into the arena where the champion lies already conquered! With what timidity should justice herself invade the temple of the fine arts, to slay over again the already vanquished hero! Let us inquire who is M. Pétiau, the person here accused. He has lately returned to his native city of Valenciennes from the School of the Fine Arts at Paris; he is one in whom the most brilliant talents have been developed by the most skilful masters, and who, decorated in five successive contests with the most eminent distinctions, has at length returned to fix himself in his own country at the foot of this fatal tower, with the modest but honourable title of Architect to the town.

"I shall not pretend so to interpret the ancient usages and laws upon this subject as to contend through them for the irresponsibility of the accused, but I do boldly maintain that it is in architecture as in medicine, in surgery, and in military strategy, that the innocence or guilt of men is not to be measured by their success or failure, but by the degree in which palpable error can be proved against them. Before an unfortunate artist can be made the subject of punishment, it must be established upon clear evidence that some inexcusable fault has been committed, some gross offence against the principles of art, some error of omission or commission so obvious as to fall under the notice of the senses, and then, when this has been clearly proved by correlation of cause and effect, to have led to the accident in question, it is time to condemn."

Proceeding, then, to the special circumstances of the case, the advocate shows that M. Pétiau is not even the author of the project of reparation

which has thus signally failed. That the project, on the contrary, was conceived by other architects, was adopted by the municipal council on the report of its own commission, was afterwards sanctioned by the council of buildings for the department of the north; and as for M. Pétiau, it was only after having unsuccessfully contended against this project for four years, that he at length consented, with equal modesty and resignation, to lend his exertions towards its execution. "When these exertions have proved unsuccessful, is it right that the punishment of failure should be visited upon his head alone?

"The prisoner is accused of not having foreseen immediate danger to the whole mass from the great rent which took place on the 3rd of April, but have you not heard, on the testimony of a municipal councillor, that similar rents had existed in the tower for the last forty years? Figure to yourselves a doctor of medicine placed at this bar on the charge of having promised life and recovery to a patient whom it had pleased Heaven to remove the very next day; and then mark this difference, that the doctor has the advantage of receiving responses from the patient himself as to his most inward feelings and the symptoms which might indicate an approaching dissolution. But on the other hand, this massive and impenetrable tower was silent to all inquiries, and gave forth no sound in answer to the voice which might demand the inward symptoms which preceded its sudden destruction.......

"The architect, then, is irreproachable in every point of view. Let justice address herself to others, if a victim be indeed necessary. But in my opinion, the individual is not to be found upon whom the punishment of offended law can with justice be visited. The fall of the old tower was one of those misfortunes which Providence, alas, too frequently suffers to fall upon poor humanity. These are the consolations which remain for the able though unfortunate architect. Pardon, then, in the name of justice! pardon, for the sake of the academic laurel which yet crowns his youthful brow."

This able address was followed by an honourable acquittal of the architect, and the court, reversing the judgment of the inferior tribunal, ordered him to be set at liberty without costs.

STYLES AND METHODS OF PAINTING SUITED TO DECORATION OF PUBLIC BUILDINGS.[1]

By C. L. Eastlake, Esq. R.A.

The numerous public edifices which have of late been completed in France and Germany have, in almost every case, been embellished with the productions of painting and sculpture. This application of the imitative arts has prompted inquiries into the principles which may regulate the adaptation of those arts, and especially of historical painting, to architecture; not without reference to the examples of success and failure which the decorated buildings of former ages present. The same question which is now proposed for solution in this country, in the intended decoration of the Palace at Westminster, has been considered and practically answered with various success in Munich and in Paris. The experiments that have been made in those cities by artists of eminence and the opinions that have been expressed thereupon by competent judges, form, therefore, an important addition to the evidence of older works of art, and may assist in the examination of the subject.

The union of painting with architecture supposes a principle of adaptation or selection, in the style of one or both. The architect, in arranging his spaces, might find it advisable to adapt their size to the distance to which the spectator could conveniently retire to contemplate the paintings; or might be induced to vary the form of such spaces, with a view to certain subjects. But the principle of adaptation is most indispensable for the painter: for if, in such a combination, the productions of painting should appear as adventitious ornaments, varying according to the taste or caprice of each artist employed, the result might be a mere gallery of pictures. This mistake seems to have been committed to a certain extent in the church of the Madeleine at Paris. The defect is said to be the more striking, as the subjects of several of the paintings relate to the life of the Saint, who is represented very differently in different works according to the conception of each painter. In such an assemblage of pictures, whatever might be the degrees of merit, the spectator would look in vain for any evidence of a similarity of aim.

It therefore appears that, whether one or many hands be employed, some common principle is necessary as a means of ensuring a due harmony of treatment. But before entering further into the consideration of this question, it may be desirable to examine the opinions that have been expressed elsewhere in similar circumstances, reserving for the concluding observations the comments which particular passages may appear to require. An Essay in the "Revue Générale de l'Architecture" may be quoted first. The remarks of the writer are suggested by the celebrated work of M. Paul de la Roche, painted in oil on a semicircular wall in the Ecole des Beaux Arts at Paris. It is unnecessary to refer to the opinions relating to that particular work, but some of the more general observations may not be undeserving of attention. The following is a translation.

"When first the architect opened to the painter the doors of a recently finished edifice, and showed him the walls which were to be adorned by his skill, an elevated art arose, the essential principles of which were at once defined by the conditions of this union. This art may be called mural, or monumental painting. Its characteristics are so pronounced, and so distinct from easel-painting, that perhaps the relation between the two might be aptly expressed by the circumstances attending their respective modes of execution; by comparing the eternal walls of a temple with the fragile stretching frame under which the easel trembles.

"Painting being employed to decorate large and solid surfaces, the artist is no longer intent on the re-production, however ingenious, of reality in its most limited sense. A dignified subject is essential, and to this genius is required to add ideality or elevation of treatment. Lastly, simplicity, the indispensable characteristic of great works, must be apparent in the composition and in the execution. Hence arises the especial condition of excluding from mural painting all that may interfere with grandeur of effect—all that aims at literal imitation and illusion. It is to be remembered that the painter is, in this case, not alone; his art is employed, together with that of the architect, in decorating the same interior. There can be no difference of purpose between these two exponents of one and the same thought; and if one art is dependent on the other, it is that of the painter. It is further to be remembered that the walls must always be felt to exist under the decorations that cover them, and the skilful and magic effects by means of which the painter gets rid of the flat surface would here be out of place.

"Thus, under whatever point of view this question is considered, monumental painting must still be limited to an elevated region, where all is grand, simple, and unaffected. It is thus that its style was defined by the great masters who, from Giotto to Michael Angelo, covered the walls of the palaces and temples of Italy with their works. They painted in fresco; and Michael Angelo, foreseeing the decline of the grandest style, had reason to call easel-painting an occupation for women.[2] From this period (the middle of the 16th century), the tradition of elevated art was unstable. Succeeding painters, down to Pietro da Cortona, poured over vast surfaces their crowded compositions in which the qualities of fresco became useless. To complete the decline of monumental art, it remained only to neglect the process itself. Accordingly, from the beginning of the 17th century, oil-painting was introduced commonly on walls, particularly in France; and the artists looking on this mode of painting as an opportunity for displaying the effects of foreshortening, perspective and colour, produced what the Italians called vast 'machine,' differing only from the decorations of the theatre by better studied forms and a more finished execution. We have no right to consider modern artists responsible for this practice; it is to be dated from those painters who first lost sight of the conditions which regulate the style of painting when that art is applied to architecture.

"The rich and varied effects which characterize oil-painting are ill applicable to a severe style of architecture. The brightness of tints, powerful relief, the finish of details, are resources easily abused, especially when the artist has been long accustomed to them. Such means require, on the contrary, to be subdued and simplified, so as not to transgress the limits of a well-understood style of decoration. To these objections it may be added that oil painting applied to walls has no principle of durability or solidity, especially when employed on large surfaces. The experienced chemist, M. Darcet, who has made science available for so many practical objects, thought that he had remedied this defect by preparing walls with new grounds for painting."

[1] This paper forms Appendix N[illegible] the Second Report of the Commissioners on the Fine Arts.

[2] This often misrepresented expression of Michael Angelo appears to have been uttered in a moment of irritation, and to have been intended as a rebuke to Sebastian del Piombo. Vasari thus explains the occasion, in his life of that artist: "A misunderstanding arose between them, in consequence of Fra Sebastiano having persuaded the Pope (Paul III.) to direct Michael Angelo to paint the Last Judgment in oil, whereas he would only consent to execute it in fresco. But as he was silent at first, the wall was prepared for oil painting, under the direction of Fra Sebastiano. Michael Angelo suffered several months to pass without beginning, and being at last pressed to proceed to the work, he declared that he would not undertake it unless he was allowed to execute it in fresco; adding that oil painting was an art for women, and for persons in easy circumstances and of indolent habits, like Fra Sebastiano. The Frate's priming was therefore removed from the wall, and the surface was prepared anew for fresco."

The writer here refers to the dome of the Pantheon, painted by Gros, and adds, that the work has already suffered in some places.[3]

"It may be admitted," he continues, "that fresco is not better fitted to resist the action of a humid climate; yet the frescos of Mignard, in the church of Val de Grace, are well preserved, although the retouches in coloured crayons, added by the artist after the work was completed, have faded. After all, the question of durability need not be considered so all-important; even if we could succeed in rendering oil paintings on walls durable, it would be impossible to give them those qualities fitted for architectonic decoration which belong to fresco, and which caused that method to be preferred by all the great masters of the Italian schools. But although fresco admits of the design being studied to any extent in cartoons, yet in its ultimate execution it is not an art for the hesitating and timid. It requires a grand style of drawing, a broad and simple treatment of colour, an eye steadily fixed on the whole effect, and an energetic and rapid hand—all qualities which it must be confessed are rare in these days. But if fresco cannot be successfully encountered by all artists, there is another method which is at least as ancient, and which France had first the honour to revive, though its practice is now familiar to many; I mean encaustic painting, which is applicable to all grounds, and which consists in employing the colours mixed with wax, and prepared for painting by means of essential oils. The colours, which are used as in oil painting, may be blended so as to give the effect of the highest finish by subjecting them to the action of fire, by means of a cauterium. This method, which has been employed with success of late years for monumental decoration, has all the resources of oil-painting; but the artist may moderate the brilliancy of tints as he pleases, and give them to a certain extent the *mat* (unshining) but luminous tones of fresco; he may return to his work as often as he pleases; while the painting, notwithstanding the changes of temperature, attains a solidity greater even than that of fresco.

"The school of Munich, which has at least the merit of adhering to the ancient traditions of monumental painting, has employed these two methods only; one for religious and philosophic subjects, the other subjects borrowed from history and poetry."

To the above may be added the following extracts translated from a "Memoir presented to the Prefect of the Seine, by MM. Lapère and Hittorff, architects, relating to the decoration of the new church of St. Vincent de Paul."

"In the present advanced state of the church of St. Vincent de Paul, it becomes necessary to consider its permanent decoration. We have therefore the honour to submit our ideas as to the fittest application of painting and sculpture for this end.

"In studying the most remarkable monuments of the best ages of art, it is invariably found that the architect's work was completed by the production of the painter and sculptor, and that those monuments, by a happy union of the three arts, presented the most striking and attractive effect which human ingenuity could devise.

"Another circumstance, not less important, which is apparent in such an examination is that, wherever this union of architecture with painting and sculpture has produced great results, *one* directing thought appears to have influenced the whole.

"If there are few instances in which a single individual has practised the three arts with sufficient power to conceive and execute alone an entire monument, there are many to prove that edifices prepared by the architect to be decorated with paintings and statues have been intrusted to one painter and one sculptor. This was the surest means of obtaining a characteristic result in harmony with the architect's creation, and which, instead of weakening the effect of that creation, would contribute to its complete impression. It was thus that the immortal works of Greece and of ancient Rome were produced, as well as the masterworks of modern art.

"That this system was in itself judicious, is easily comprehended. The force and clearness of the idea, the agreement between the conception and the execution, in a word, harmony—that quality without which no work of art can be complete, was the result of one pervading feeling which, in the infinite multiplicity of detail, preserved the unity of a whole."

After referring to the decorated architecture of the Greeks, the authors remark that

"Many later edifices, imperfect as they may be in details, are yet admirable for this unity of impression.

"Among such examples may be mentioned the Basilica of Monreale and the Royal Chapel of Palermo, as true traditions of the principle of Hellenic art; for in these, historical painting in the form of mosaic (the only decoration employed) is so adapted as to leave no doubt in the spectator's mind on two points, viz. that the buildings were designed for the paintings, and the paintings for the places they occupy.

"We here find pictures in which the subjects, importance, number, treatment, and distribution have depended on the situations which the architect's arrangements afforded, all as if guided by one directing thought.

"In contemplating the harmony and majesty which these churches present in their masses, and the poetic and moral impression produced by their decorative details, the spectator at once feels that this grandeur of effect is mainly owing to the unity of creation. It is also easy to conceive that this impression would have been destroyed, or would have been far weaker, if the decorations had been subdivided and allotted to a great number of artists, whose works would have been variously conceived and executed. The merit of such productions, in individual instances, would not have compensated so great a defect."

The authors proceed to express their conviction that the similarity of the grounds on which the figures were painted, in addition to the similarity of style, contributes to the effect of the whole.

"The use of gold for these grounds shows, besides, that the artists did not then attempt to do away with the walls, but only to give to the stone the appearance of a precious material. The simplicity and sedateness in the attitude and expression of the figures, as well as in their execution, are not calculated to disturb the impression as to the reality of this wall of gold. Hence we find none of those abrupt effects produced by grounds of all colours and varieties, nor those attempts at illusion which in historic mural painting are so injudicious, presenting hollows where there should be solidity, undulating lines where there should be plane surfaces; in short, uncharacterizing the architectural forms—forms which painting should preserve and assist, but never alter or suppress."

The authors then refer to three kinds of art which have been revived or invented of late years, namely—encaustic painting, painting on glass, and enamel painting. The last, it is observed, combines all the qualities of mosaic and porcelain with many important advantages. The authors remark, that

"Painting even on the exterior of sacred public edifices was not confined to the south, but had been employed in severer climates. Germany and the old and new capitals of Russia contain examples. Such external decorations lasted better in Egypt than in Greece and Italy, and better in the south of Europe than in the north. Hence more durable materials are required in the latter cases. Mosaic had been first adopted with this view; porcelain, treated as it was at the revival of art, could in some degree have answered the same purpose, but nothing could fulfil all the desired requisites so satisfactorily as the enamelled lava.[4] More durable than mosaic, more under the command of the painter, so as to enable him to give the greatest perfection to his work, this beautiful invention, in its application to the exterior of the Church of St. Vincent de Paul, may rival the most remarkable effects of the kind that art has produced."

The authors afterwards propose that Raphael's compositions from the Old Testament should be executed in enamel, to adorn the cella of the portico of the new church.

In the decoration of the interior they recommend encaustic painting,

"Now sufficiently tried at Fontainebleau, at Munich, and in Notre Dame de Lorette and in the Madeleine, at Paris."[5]

MM. Lepère and Hittorff next recommend that certain prominent portions of the internal decoration in the nave and sanctuary, and which belong to the general *coup d'œil* should be entrusted to one, or at most to two artists; but the side chapels and various other places, they admit, might be allotted to various hands. They assume, however, that the universal gold ground which they propose to adopt, will compel all the artists to a sufficient unity of style and effect. The observations on sculpture are dictated by the same principle of preserving a harmony in the general effect and in the style of those works that are seen together.

The opinions of German artists and critics, on the adaptation of painting to architecture, correspond with those above quoted.[6] Mr. Wilson states in his notes:—

"Professor Hess observed to me that great care must be taken to avoid contrasts of effects in a series of pictures on the same wall. The same spirit, he observed, must pervade the whole in the design and colour, and as nearly as possible in the light and dark. If, for instance, an artist were to represent a broad daylight in his first picture, in the next a fiery sunset, and beside that again a night scene, such contrasts would interfere with the architectural unity which is essential."

[3] Compare the opinion of Mr. Wilson, before quoted.

[4] Lava slabs of large dimensions are obtained at Volvic in Auvergne; they are fire-proof, and figures the size of life are executed on them in enamel.

[5] The trials of encaustic hitherto made have in many instances been far from satisfactory, chiefly owing to the effects of damp in ill-prepared walls.

[6] See the article Fresco, in the "Conversations Lexicon."

After noticing the works in the church of the Madeleine, before referred to, Mr. Wilson quotes some defective Italian examples, and adds:—

"Paul Veronese, as might be expected, from his oil pictures, is more effective, and perhaps may be said to paint in fresco on truer principles of colour than any other Venetian master; but his taste in design is open to criticism. In the Villa Mazer he has everywhere annihilated the architect's intentions, and has so painted the walls and ceilings as to convey the idea that the spectator is looking out to the country and up to the heavens, while the windows in the room contrast the reality with the artist's intentions. Such extravagances, perhaps pardonable in the fanciful decorations of a villa, were carried to excess by the later Italian artists. Vaulted roofs of churches or rooms were frequently painted with perspectives of gorgeous edifices, while portions of clouds and figures were brought down, by means of express plastering, over the real cornices and mouldings. In S. Andrea della Valle in Rome, even Domenichino has indulged in such perverse and unworthy conceits.

"We may, on the other hand, gather from the examples of the best masters, that an idea of unity should pervade a series of pictures executed in one place; but still there are difficulties in forming a just opinion of the true mode in which painting should be thus applied. By some of the German artists the difficulty has been met by representing the pictures as tapestries nailed to the walls;* in other cases they have painted the figures on gold grounds, in imitation of the mosaics in the ancient Byzantine churches."

Adverting to the decoration of churches at the revival of art, Mr. Wilson proceeds:—

"Blue was substituted at a later period for gold, and this is exemplified with most completeness in the Cappella degli Scrovegni at Padua, painted by Giotto, which may be deemed a perfect example of Italian Gothic church-painting.

"In this building, as in other Italian Gothic edifices, the vaulted roof is painted blue, and is divided into compartments with stripes of ornament; in other buildings where there are ribs in the vaulting, this ornament, which is of a geometrical character, is confined to these, and to a small space on either side of them. In each compartment of the vault there are circles of characteristic ornament, in which are painted heads and even whole-length figures of the Evangelists, or their symbols. At a subsequent period the circles were dismissed, and the figures were painted standing on light thin clouds; at all times the blue background, sometimes very dark, at other times light, was spangled with gold stars, frequently executed in relief. In Sta. Maria del Popolo, in Rome, Pinturicchio has introduced a beautiful variety in this mode of decoration; he has seated the figures on thrones, and diapered the blue background with a rich gold pattern. To return to the Cappella degli Scrovegni; the paintings on the walls are divided from each other by broad ornamented bands vertically, and by narrow ones horizontally; in the vertical bands are octagonal spaces, with heads of saints, coats of arms, and subjects composed of two figures, and all these bands are richly painted with various colours. The figures are all on a ground of plain blue, of the same tone as that of the vault overhead.

"In the Farnesina, Raphael has restored the ancient mode of treatment, which had been departed from even by Giotto himself on the walls of Assisi and which was never revived by any other artist till Raphael adopted it in the above instance."

The extreme opinions of the continental artists and critics above quoted, are to be tried by a reference to the masterworks of Italian art, and by an examination of the conditions resulting from the union of painting with architecture.

Fresco having been decided on for the decoration of portions of the Palace at Westminster, the question of methods need not for the present be further discussed; but it may be remarked that the arguments for or against particular modes appear to depend on the following considerations:—the influence of the practice of a given method on the style of the artists; the inclination of the artists; durability; applicability to architecture; the resources of the method; and the convenience of execution. The absence of a shining surface for paintings on walls seems to be generally considered desirable, and in the present case is especially recommended by the architect.† It is easily attainable in all modes, the enamelled surface above referred to excepted. The employment of other methods than fresco, it has been observed, might admit of the work being executed on strong panel, to be afterwards inserted in walls, thus avoiding the objections to canvas; but panels of the sizes required could not be easily introduced into painting rooms of ordinary dimensions. M. Paul de la Roche, who recommends painting in oil on the wall itself admits that, to avoid the black and heavy appearance which old oil-paintings thus executed present, it is necessary to adopt a light style of colour, and to admit a large proportion of illumined masses.‡ This leads to the consideration of the question of style, and of the restraints to literal imitation which are supposed to be necessary.

The gold ground, recommended by the writers above quoted, might be at once dismissed without comment, as it has never been proposed as a background for figures in the intended decorations; but it is to be observed that there is no example of it in the celebrated paintings of the great masters, with the exception of Raphael's first work in the Vatican, viz., the ceiling of the Camera della Segnatura. It may have been objectionable to them, even in works where no background was introduced, because, as is evident from the instance just quoted, it is an unsatisfactory imitation of mosaic; the comparative dulness and heaviness of the colours contrasting ill with the splendour of gold. It is just, however, to state that all who have seen the works of Professor Hess, thus executed on a large scale at Munich, have been no less struck by the general splendour of effect than by the grandeur and beauty of the inventions.

The opinions respecting the supposed necessity of preserving the flatness of the real wall, whatever means may be adopted for such an object, must be especially objectionable to painters, who feel that the triumph of their art greatly consists in apparently doing way with the plane surface. Nevertheless, it will be admitted that an art which professes to be the auxiliary of architecture, may require to be more or less modified in particular cases in order to attain the union proposed. The qualities which constitute the abstract completeness of imitation are limited, even in ordinary practice, by various causes; by the style of art, by the subject, and by dimensions, without any reference to the particular place for which the work may be destined. The conditions of situation, and of relation to a building, are new to artists in this country, but must be acknowledged to be as obligatory as those which they are in the habit of fulfilling.

M. De la Roche, though, as before observed, an advocate for oil-painting on walls, thus writes to Mr. Wilson: "Monumental painting is an art by itself, requiring no less experience than invention, and should an opportunity of the kind again present itself for me, I shall endeavour to show that I have profited by the observations which I have made during and since the execution of my work" (the hemicycle before mentioned, in the Ecole des Beaux Arts.)

The arrangements with respect to light being assumed to be satisfactory, the general conditions in question may be reduced to three—the purpose of the building, the magnitude of the halls or rooms to be painted, and the style of the architecture. The purpose of the building must regulate the selection of subjects, and, to a certain extent, their style. It is inexpedient here to enter upon the consideration of the selection of subjects, but the dimensions of the rooms are given by the architect, and must always constitute an important condition, not without some influence even on the subjects. Figures in paintings which are required to decorate vast halls may require to be larger than nature, and it will generally happen, as a consequence of such enlargement, that little space remains in the picture for background. On the other hand, colossal figures in a small room, even where the idea of a supernatural size is intended to be conveyed, are unsatisfactory, as the spectator is quite near enough to perceive details, and finds none, except those belonging to the execution of the work and which ought not to be visible. This unpleasant effect is produced in the "Sala de' Giganti," by Giulio Romano, at Mantua.

In the suite of apartments or Stanze in the Vatican painted by Raphael, the compartments for pictures are as large as they can be consistently with the size of the rooms. In the first work there executed by him, even the foreground figures are not larger than life. As the great artist proceeded in his labours, he increased the size, and reduced the number of the figures, till his eye was satisfied.

The limited distance, compared with their size, at which these works are seen, may in like manner have determined the style of execution, and ultimately in some degree even the subjects. In the Camera della Segnatura, which at first appeared to be the only room which could be allotted to Raphael (the others being then occupied by the works of older artists), the subjects, such as philosophy, poetry, &c. are abstract; but when directed to re-paint the remaining rooms, the experienced artist adopted or approved of a class of subjects which required various details, such as it is natural to look for in objects seen near.

On the same principle differently applied, when Michael Angelo began the ceiling of the Sistine Chapel, he filled three compartments with numerous small figures and a variety of incidents; but finding that such a style produced no effect from below, he suddenly enlarged

* There are examples of this in the Hall of Constantine and on one of the ceilings of the Stanze in the Vatican.

† See Architect's Report.

‡ Letter from M. De la Roche to Mr. Wilson.

the figures of the next compartment of a colossal size: they thus occupied the whole space, leaving no room for background. Having once satisfied himself as to the necessary size, he adhered to it throughout.

The tapestries executed from Raphael's cartoons were originally destined for, and ultimately hung up in the Sistine Chapel, round the Presbyterium. In the cartoon which, from the intended situation of the tapestry and from other circumstances, appears to have been executed first, viz., the Miraculous Draught of Fishes, or Calling of Peter, the figures are comparatively small; in all the rest, the size of the figures is greatly increased.[10]

These examples may suffice to show that the distance from which the spectator is supposed to contemplate a work (sometimes as a part of an extensive decoration), not only defines the size of the figures, but also regulates in a great degree the quantity of detail, and consequently the selection, or at least the treatment of the subject.

In the instances of the Stanze of the Vatican and the ceiling of the Sistine Chapel, the great artists made their own arrangements respecting the spaces or compartments. In the Palace at Westminster the distribution of the spaces has already been fixed by the architect. The distance at which paintings in the Victoria Gallery will be seen will be considerably greater than in the Vatican, not so much from the difference in the dimensions of the rooms (the Victoria Gallery being 45 feet wide, and the Hall of Constantine, the largest of the suite in the Vatican here referred to, being not much short of that measure), as from the smaller space which the architect proposes to allot to each painting. As it is, the moderate size of 12 feet is fixed.

The apartments of the Vatican to which the Hall of Constantine forms the approach, vary in dimensions and are not all rectangular. The room called the Camera della Segnatura measures about 35 ft. in the longest dimension. Single frescos, with the addition of a painted frame-work, occupy each wall. The paintings called Theology and Philosophy (or the Dispute of the Sacrament and the School of Athens) measure, without reckoning the painted frame-work, about 26 feet 8 inches wide;[11] so that the utmost distance to which the spectator can retire from either is not sufficient for the eye to embrace the whole composition. The base of the paintings is, however, above the height of the eye (in the other rooms higher than in this), which somewhat increases the distance; but in the Hall of Constantine, measuring about 60 feet by 42, the large fresco of the Battl with Maxentius, about 36 feet in extent,[12] on one of the side walls, cannot be viewed at the minimum of distance which is necessary to see the whole of a picture.[13]

The ceiling of the Sistine Chapel is about 60 feet from the ground; the size of the single compartments has no relation to this distance which would admit of pictures measuring from 30 to 40 feet wide; but the size of the figures (with the exception of those in the three compartments before mentioned) is perfectly well calculated for their situation. Those in the coved part of the ceiling, as is well known, are still larger, partly perhaps with a view to counteract the effect of the curve. The head of the Delphic Sybil measures about 2 feet, giving a height for the entire figure, if it were erect, of nearly 16 feet.

Thus, even where single paintings and compartments can be duly embraced by the eye, the Italian painters seem to have considered that the effect of each should be subservient to that of the whole wall or ceiling, though that whole, strictly speaking, could not be comprehended at one glance. Instances, it also appears, are not wanting in which the size of the apartments does not admit even of single paintings in it being embraced by the eye at once. This may be a sufficient excuse for the absence in such works of any general effect of chiaro-scuro. The principle of making the effect of the various compartments subservient to the whole scheme of decoration appears therefore to be one of the points in which the equality of architectural embellishment may, in some degree, require to be extended to painting, and in which the unpicturesque principle of repetition is in danger of superseding concentration. The resource of the painter, as exhibited in all the examples quoted, is effective composition, through which, elevation, isolation, &c., may render the principal objects striking, and a gradation of importance may be attained by skilful arrangement. There are, however, instances in which the effect of mural paintings of vast size, and which are seen alone, approach the concentration of effect common in easel pictures. A cupola seems to suggest this treatment; a single painting occupying the end wall of a chapel, or of a hall, and which may be seen at a sufficient distance, admits of the principle of concentration (subject to the conditions arising from its adaptation to architecture), inasmuch as it is a whole in itself. Thus, judging from its present remains, there appears to have been a treatment of light and dark in Michael Angelo's Last Judgment different from that of the ceiling subjects. The enlargement of the figures in the upper part of the fresco is rather to be accounted for by the principle before followed by the great artist in the ceiling, namely, that of adapting the size of the figures to their real distance from the spectator; for it may here be observed, that the perspective diminution of figures is confined to narrow limits in the works above mentioned, and in those of most of the Italian masters, Correggio and his imitators excepted. This restriction is a necessary consequence of the general aim of the severer schools—an aim which was only recognized by Correggio in subservience to his favourite qualities of chiaro-scuro and gradation. The other great painters seem to have considered that figures reduced to minute dimensions by perspective may express distance, but, in general, nothing more. The real subject of Correggio's cupolas may be said to be space; the subjects of the mural paintings of Michael Angelo and Raphael are rather human action and thought.

With respect to the attempt to do away with the real surface of ceilings by perspective appearances, a practice so much abused in the decline of art, it would be a mistake to suppose that the representation of an immeasurable space overhead, with violent foreshortening, as seen in the cupolas of Correggio, was altogether new in Italy in his time; and it would be equally erroneous to conclude that the great artist who painted for Julius II. were unacquainted with efforts of the kind. There was a remarkable and early example in the Church of the SS. Apostoli in Rome, by Melozzo da Forli, in which a foreshortened figure of Christ, represented in the subject of the Ascension, "seemed," to use the words of Vasari, "to pierce the roof."[14] Michael Angelo, of all artists, would have been the last to shrink from the difficulty of foreshortening, but he preferred the more judicious, because more intelligible and expressive representation of figures, seen as if opposite to the eye, and not as they would appear above it. In his as well as in Raphael's ceiling pictures, the horizon is often introduced as it would be in a painting on a wall.

But to what extent, is the characteristic aim of painting, viz., the representation of roundness and depth on a flat surface, to be sacrificed or limited in the adaptation of painting to architecture, and how far are the observations, on this point, of the writers above quoted to be looked upon as valid? The answer may be furnished by the examples before mentioned. From those examples it is apparent that the larger the dimensions of the figures, (the necessary consequence of the distance at which the work may require to be viewed,) the more abstract must be the representation, and the more it requires to be reduced to expressive essentials; that, on the other hand, where the spectator can only retire a few feet to contemplate a painting, the eye demands a greater fulness of parts, and more gradation; but that in no case can the imitation descend to the style of cabinet pictures, in as much as the compartments, however small, are always to be considered as portions of an extensive whole.

The apparent contradiction of the omission of detail, in proportion to increase of size, was adverted to in a paper in the appendix to the former report, and, bearing as it does on the question under discussion, may be more fully stated on the authority of various examples, as follows:—

The representation, without reference to its frame or boundary, is required to expand as it recedes from the eye; this increase of size with distance (or of distance with size) being indispensable, in order that the work, as a whole, may be duly seen. But this progressive enlargement is confined to significant forms and objects; things less important are gradually omitted, notwithstanding the general increase of size. The extreme effects of proximity and distance correspond in some respects, for works of art may be so small that their leading features only can be perceptible: this effect is equivalent to that of distance. Thus, engraved gems often exhibit a grandeur of style fit for colossal figures. On the other hand, the degrees of distance to which the style of highly-finished cabinet pictures may be said to belong, are defined by the average range of most distinct vision. Beyond and within that limit, whether the pictured plane diminishes

[10] The cartoon of Paul preaching at Athens may offer an exception: the subject demanded a display of architectural magnificence; but even here the principal figures are much larger than in the cartoon of the Calling of Peter.

[11] Passavant, in his life of Raphael, gives the dimensions 25 ft. by 15 ft., French measure.

[12] Passavant (*ib.*) and Bunsen (Beschreiburg der Stadt Rom), give the dimensions 50 palms by 22.

[13] Once and half the width of a picture is considered the minimum of distance to which the spectator can retire to see its whole surface. A circle cannot be embraced by the eye till the spectator retries to a distance equal to thrice its semidiameter.

[14] Part of this work is now preserved in the Vatican.

as it approaches, or expands as it recedes from the eye, detail is either less compatible with effective representation, or is less perceptible.

The following considerations may tend to explain the practice in art to which this statement refers. The scale of mere magnitude still increases with increasing distance, as the picture becomes enlarged, and it would at first appear that, at any and every degree of distance, the eye must continue to receive an equivalent impression. This cannot, however, be literally the case; for the scale of other qualities, such as sharpness and softness, and light and darkness, may be already complete in a picture requiring to be seen near; consequently, that scale cannot be increased by increased dimensions, while it must be reduced by increased distance. But as it becomes reduced—as sharpness, force and gradation become impaired, notwithstanding the increase of dimensions, the omission of detail becomes unavoidable; for it is essential to completeness that the quantity of parts should not surpass the existing technical means of expressing their relative importance.

The restrictions which in this instance are a consequence of distance and dimensions, are more or less expedient in all modes of imitation in which the organ of sight is less fully informed. The incompleteness in the appearance, as in the case of the absence of colour in sculpture, being compensated by greater general distinctness, and by a representation unencumbered by accidents.

Perhaps the most remarkable examples of this relative completeness or independence of style occur in the outlines and monochroms of Greek vases. In these works, the line being assumed to vary but little in thickness, the means of representation may be said to be reduced to the lowest degree. Yet a certain gradation is still preserved. The quality of smoothness in forms is expressed by the omission of internal markings; without background, the scene is indicated by a significant stenography. Parts only of some objects are introduced; others (the presence of which may be inferred or imagined from the position of the figures) are entirely omitted; as if that which reduced figures to a mere outline, rendered subordinate objects invisible altogether.

Flaxman has shown that the language of abstract form (apparently requiring no addition of light and shade to assist its meaning) can be employed quite as emphatically with less convention; but the same general principles are recognised in his designs.

The consistency which is maintained even on so limited a scale, is not less apparent in the works of great artists, in modes of imitation which afforded ample means of expression. From the restricted department of art referred to, in which so much beauty was nevertheless condensed, to examples of painting, which have exhausted the resources of imitation, the world has always awarded its approbation to completeness of style, and to the docility which has kept it in view under the conditions of subject, material, place, and dimensions.

Sir Joshua Reynolds observes that Michael Angelo, in the Sistine Chapel, attempted little more than could be attained in sculpture; nevertheless, it has been remarked that the ceiling of that chapel, as an example of decoration and of the due adaptation of painting to architecture, has never been surpassed.[15] The inference is, that distance, large dimensions, and the grandeur of style which is the result, are favourable to the fulfilment of the union proposed. But although there are few examples of perspective or of backgrounds in the compositions of the Sistine Chapel, the individual figures are remarkable for roundness, and the fresco of the Last Judgment may originally have exhibited the quality of depth in a remarkable degree.

The extreme doctrine which assumes the necessity of aiming at flatness, because a wall is flat, may therefore be pronounced erroneous on the authority of the best mural paintings, and may be considered unnecessary, even as regards the end proposed. As a proof, it may be sufficient to remember that examples of oil-painting in which the effects of aerial perspective have been represented with consummate mastery, when hung up in a room are immediately seen to be flat surfaces, more or less agreeably coloured. At the same time it is apparent that the breadth of treatment which must ever be an attribute of "monumental" painting, must tend to reduce the fulness of relief. The limitation of chiaro-scuro which this supposes, involves, however, an especial attention to colour, and it is to be observed that the practice, common with the painters of Venice and Friuli, of executing large figures, calculated to be seen at a considerable distance, on the exterior of buildings, may have led those painters to feel the importance of depth of local hues, and the necessity of laying a stress on the permanent rather than on the mutable qualities of nature. The requisite which M. De la Roche thinks essential, viz., the predominance of light masses, is quite compatible with this aim; and the lightness of effect, without deficiency of force, which is the result, is a quality seldom wanting in Italian frescos. Those by Annibale Carracci, in the Farnese Palace, form a remarkable contrast to the heaviness of some oil-pictures by the same master.

With respect to the alleged expediency of intrusting the execution of a series of pictures to a single artist with a view to unity of effect, it appears, from the examples before given, that the change of style consequent upon first experiments, which may be exhibited in a series by a single artist, may interfere as much with architectural symmetry as the varieties of treatment resulting from the employment of many.

In the instance of the frescos in the Stanze of the Vatican, it should, however, be remembered, that although the contrast which some of those works present to the rest might not have been satisfactory had they formed a series in a vast hall, yet as each picture occupies an entire side, and is seen almost alone, the incongruity which to a certain extent exists is not apparent. Again, the architectural and other back grounds, which are sometimes elaborate, might have been too prominent had the compartments been of the ordinary shape; as it is, their semicircular form sufficiently reduces the space above the figures.

The condition of a peculiar style of architecture is altogether a question of taste; even authority here fails, the greatest Italian masters never having been called upon to paint in a Gothic building. The example which is most applicable may be found in the works of Luca Signorelli, at Orvieto. In those works there can be no doubt that the artist's object was not to imitate, but to surpass the ruder productions which may have been executed, there or elsewhere, about the time when Italian-Gothic structures were erected. The Tudor style of Gothic (the style of the Palace at Westminster) is coeval with the highest development of art in Italy; and buildings erected in the time of Henry VII. or Henry VIII. might have been decorated by the hand of Raphael, had he accepted the invitation of the last-named monarch to visit England.[16]

From the foregoing considerations and examples it appears that, whether the decoration of a wall or ceiling consist of one or of many paintings, the treatment should have reference to the whole extent of such wall or ceiling; and that, consequently, if the compartments be small, that circumstance does not of itself involve the necessity of a corresponding style. Hence the dimensions of the figures are not always referable to the size of the compartments, but are rather calculated for the distance from which the whole, or a considerable portion of the decorated surface can be conveniently viewed; and the usual consequence is that little space remains in the pictures for background. The cartoons of Raphael may in general be considered as models in this respect, the tapestries for which they were designed having been to all intents permanent mural decorations. It may here be further remarked that, when figures differing in size from those in the principal compartments are introduced among the architectural embellishments, they are often painted in chiaro-scuro, or in imitation of bronze, gold, or some such material, or, if imitative of nature, the subjects are supposed to be on tapestries. Such portions thus profess to be works of art, and the difference of size, as compared with that of the figures in the principal compositions, involves no inconsistency. Such, with occasional exceptions, examples of which have been before noticed, was the practice of the Italian painters.

[15] The remarkable alteration in the size of the figures before referred to, interfering as it does with the architectural symmetry, is not however to be overlooked.

[16] Dallaway's Walpole, vol. i. pp. 106—187.

Archæological Institution of Rome.—The annals of last year's proceedings of this Society have been recently published, and contain drawings and description of the Temple of Mount Ocha, near Carystus, in Eubœa, communicated by Professor Ulrichs, of Athens. This temple is generally believed to be the oldest and best preserved specimen of the kind in Greece, and is particularly remarkable for the massiveness of its walls, and the peculiar structure of its roof. The prize proposed by this Academy in 1842, for the best essay on the Coinage of Italy, has been gained by Dr. Achille Gennarelli, author of the text of the "Museo Gregoriano." He opposes many of the opinions advanced in the work published by Marche and Tessieri, under the title of "Aes grave del Museo Kercheriano," which although up to this time the standard work on Italian coinage, was yet so faulty as to induce the Archæological Society to propose a prize for another on the same subject.

St. Mary's Church, Reading.—During the course of last month three very ancient sedilia, of the early English architecture, were discovered in ruins behind the wainscotting on the south side of the chancel, the fresco painting at the back of them and the encaustic tiles being still in excellent preservation.

THE PHILOSOPHY OF CORAL FORMATIONS, AND THEIR ARCHITECTS.

CORAL (Corallium, Lat. from κορη, *a daughter*, and ἁλος, *the sea*; so derived by Minshew, because it is generated from *the sea*;) generally described as an animal growing in a plant-like form, or a congeries of animals of the polype kind: there are 15 genera at present known to us, embracing numerous species. The ancients are wholly silent on the subject of coral reefs and their architects, their knowledge, according to Dioscorides and Pliny, being confined to the white and red corals of commerce, of which they enumerate six varieties or various shades, from dull white to bright red or scarlet, the latter being held in the highest degree of estimation by the Romans, who classed them among the most valued gems. But although silent, it cannot be supposed that they were altogether ignorant of their existence, the Red Sea, sometimes termed by the Hebrews the Sea of *Zuph*, or *Weeds*, having been navigated from the earliest ages by the various tribes bordering on the coasts, the dwellers of ancient Mesopotamia carrying on a constant trade of drugs, spices, &c., with Egypt, Syria and Palestine, and eventually with European nations. We are therefore to assume that the perilous reef and its beautiful architects were well known to them, as they are to the Arab and Abyssinian traders of the present day, under the general term of stony plants or weeds. Cæsalpinus, Boccone, Ray, Tournefort, Geoffroy, and Hill, class coral among marine plants, maintaining that it is propagated by seed like unto vegetables, and Count Marsigli, who was a very attentive observer, supposed he had discovered its flowers and fructification; but the more minute observation of M. de Peyssonnel led to the discovery that what Count Marsigli mistook for flowers, was no other than a congeries of minute insects inhabiting the coral: for upon taking the branches out of the water, they immediately retired into the cellular cavities, re-appearing on immersion in water. Recent observations by Linnæus, Ellis, and others, confirm these latter views to a certain extent only, for in the face of these authorities, and of many indisputable facts, it is still a subject of dispute as regards fungi, sponges, and other species, and throughout the whole, the link of life between the animal and vegetable kingdoms is so finely drawn as to be indivisible, the beginning and the end being lost in the subtilty of nature's workings.

The coral polyps, which are invisibly minute in their atomic structure, perform a most astounding part in the production of earths, and of fossil and mineral compounds. Governed in their distribution by habit and generic character, they generate in groups and families in localities favourable to the propagation and increase of their kind; or they are disseminated by the tidal currents, or by organic or inorganic substances to which they attach themselves, throughout the various regions of the element in which they live. In the colder latitudes, or in the lower depths, they are known as naked polyps, being of the lowest order of organization and simplicity of structure, gelatin and albumen together, or gelatin alone, with sea water, being the chief, and in many instances their sole elementary compounds: but, as they approach the surface of the waters in temperate or tropical regions, their organic structure becomes more rigid, and to the above simple material is added, calcium, magnesium, sodium, iron, ammonia, marine acids, and other well known products, by which, in warm and tranquil seas, they become the unconscious architects of hills and chains of hills, mountains and chains of mountains, rising above the waters as islands and portions of continents.

The coral polyps are living but not sentient bodies, being mere impulsations of life; they are rapidly generated in warm and tranquil waters, and as the grasses of the field, as rapidly disappear before the influences of climate, of disturbance, and of the countless creatures of the deep that prey upon them. Preserved from those contingencies common to all forms of life, such is the peculiar economy of their structure and organic action, as to admit of a very brief period of individual existence, the tender offshoot, like that of the flowering shrub, being soon hidden in the more consolidated structure of the compound body; every simple body, however minute on its parts, having limits to its extent, such limits being defined by and depending in its nature, quantities, and qualities, and the influences by which it is generated and governed: every compound body having also limits to its extent, such limits depending, in like manner, on its nature, quantities, qualities and local influences, the same being perfect results of the day, still perfecting by acquisition of parts and quantities, and passing through the brief but successive stages of development, from birth to maturity and from thence to decay.

Many of these bodies propagate their kind by separation of parts, every particle of the body having capacity, under favourable circumstances, to produce life: thus species are propagated and sustained: of such are the naked polyps. Other species increase by the multiplication of their parts until they have attained a certain size, defined by the accidents of clime and association; and becoming matured, their gemma or buds drop off, and carried away by the waters, are generated therein, affixing themselves to some organic or inorganic body where they increase and multiply their species; others are permanently fixed to their primary bases, and increase by multiplication of parts in a manner precisely similar to the growth of plants, ramifying into shoots and branches, and becoming eventually one peculiar body of a plant-like form, and having the appearance and qualities characterizing species. The progressive development and growth of fungusa or mushroom species in the ocean and on the earth is precisely similar, although the one is said to belong to the animal, the other to the vegetable kingdom; both the one and the other spring from corruption or decomposed organic matter—both are developed by a gradual enlargement of the entire body, stem and crown produced by multiplication of parts—both attain a defined size and form distinguishing species and characteristic qualities—both multiply by their seed given forth through their cellular cavities—and both are incapable of propagating by slips and cuttings. The same beautiful coincidence may be remarked in many of the madrepores and millepores, their organical, mechanical, and chemical action similating with terrestrial plants, each having root and stem, branches and leaves, each having its ascending and descending sap, and a governing action embracing the whole system; the stems of the corallines are composed of capillary tubes whose extremities pass through the calcareous crust, and open into pores on the surface, and such is the disposition of plants. Many of the corallines consist of a single tube, as for instance, Tubularia, or pipe coral; here the tube rises in the form of the cup of a flower, such as the primrose: at first it is merely a flesh-like film contracting towards the base when taken from the water, and expanding when replaced in it; this film, consisting of gelatin, calcium, and sometimes a small portion of animal oil, is the germ of the body, which strengthens with its growth, and finally becoming rigid, its individual organic action is impeded, its progeny appear and close the apex, and thus they continue to ramify into joints, and when united in groups and families, the whole contribute to form one vast catacomb, many of these jointed tubes rising up together, the living crowning the whole, and still continuing to increase so long as they are uninterrupted by destroying causes. These polyps have the usual characteristic of animal matter, but their mode of generation and development fully justify Dr. Paris and others in insisting upon their belonging to the vegetable kingdom. The same may be said of other species of the Polypiers Calciferes, which in the place of a woody fibre have a calcareous substance mixed with their animal juices, or forming their outward covering, the like organic action and development being common to the vegetable kingdom.

Polyps pass through the like gradations of change with shell fish or tender succulent plants; those of most calcareous nature not excepted. The stony polyps develop two distinct stages of existence; in the first they are naked and flexible, and it is in this state that they are mistaken by naturalists, on the one side, as tentacula of the animal, on the other as the flowers and fructification of the vegetable body. The fungous matter covering some, and the flesh-like matter exuding from or covering others, is the rising progeny of the consolidated mass beneath, convertible, and converted in the course of time into like consolidated matter; the basis beneath the external covering of fungous matter consists of consolidated matter in which vital action is still manifest, and consolidated matter in which vital action is extinguished, the latter being in many cases converted into solid limestone rock, or as is manifest in the corals of commerce, the degree of organic action similates to that of forest trees. The Madrepora Fungitis, as Rumphius observes, while living is covered with a thick viscid matter like starch, the more elevated folds or plates having borders like the denticulated edges of needle-work lace, which are covered with innumerable oblong vesicles formed of the same gelatinous substance. This, and the coarse visible rind, is the active portion of the compound body appertaining to its calcareous bases, and drawing its

vital action therefrom, as well as administering nourishment thereto, as it consolidates by abstracting its food from the medium in which it moves, so its lower portions gradually assimilate to the calcareous basis on which it is placed, and new offshoots arise to vegetate in turn their fleet existence, until they enter the second stage, and eventually into the fossil kingdom. It is upon the gelatinous viscid matter covering the surface of corals and corallines that the animals of the deep feed, it is to the vast plains covered with half naked and naked polyps, that whales, turtles, and other species repair to revel in abundance, cropping the surface, which is rapidly renewed again. Mr. Darwin is decidedly in error when he talks of fishes browsing upon the coral branches; it is true that calcareous matter is often found in the stomach of fishes, particularly those of the coral species, but it is equally true, as previously observed, that many of the polyps, while in their soft state, contain a great portion of calcareous matter, and to the continued increase of this matter the coral owes its eventual solidity. On the other hand, the generality of species while living, are filled with a milk-like fluid, fat, sharp, and astringent, and in some of the Gorgonia in particular, so powerful are its effects, as to draw blood when applied to the tongue, for while in the living state a strong electric excitement is evident in the living system: it is also a fact that minute or naked animalculæ are seldom, if ever, found located on the coral branches, the intruders being generally shell-bearing animals of like constituents with themselves. And finally, months of observation among the coral reefs have convinced the writer of this article that the delicate branches always remained uninjured by fishes, which feed upon them as ants feed upon the aphides, robbing them of their sweets alone, and leaving the body uninjured.

Lythophyta, Tubipora, Millepora, Madrepora, and Fungosa, propagate their kind through the means of their juices, which exuding from the parent trunk, fall upon the surrounding soil, become attached thereto, and if circumstances be favourable, are speedily generated, being governed in their first development by electro-chemical action, where light and heat are necessary adjuncts, in their increase, by the forces which govern vegetable bodies in their multiplication of parts; and, in their advance towards maturity, by the laws of organic life as their organical structure becomes developed. Their food is received through the cellular pores, and consists of water and the atomic particles floating therein, which, received into the living system, undergo chemical change, forming products similating with the organic body, eventually converted into the milk-like fluid, which, like the sap of a tree or the blood of an animal, pervades the whole system. From the development of the gemma or buds in many species to their full maturity of growth, they exhibit all the phenomena of terrestrial plants, being uniform in their development, growth, and decay, and propagating by their seeds and cuttings.

This similarity of action and organical arrangement would at once identify them with the vegetable kingdom, was it not for the animal matter manifest in all of them; it is certain that they differ little from fucuses and confervas, and like them are uniform in their growth, development, and decay, we can therefore only come to the conclusion that Life throughout nature is ONE, although differing in degrees: that by nature animal has no distinction above vegetable life, but acquires powers, under favourable circumstances, from the superiority of its elastic compounds and peculiarity of its organic action, which is not distinguishable in lower organizations: that when organic action is impeded by the rapid secretion of calcareous matters, the body or form, unless under intense energy of light and heat, and other favourable circumstances, is not enabled to pass the boundaries of simple organization, such as distinguish vegetable bodies: and so far as respects the stony polyps, the mixed qualities which compose the juices and the animal framework, as lime, soda, magnesia, &c. are inimical to their attaining any considerable size, or to the development of nerves, marking an advance in organic character. As regards life, they may, therefore, be considered as one with the vegetable kingdom, and that while the animal matter secreted by the functional operations of life identifies them as belonging to the animal kingdom; the action of life by which their animal matter, carbon, lime, ammonia, and other compounds are produced, and the organs of reception, retention, and motive power, by means of which they draw their nourishment from the medium in which they live, as also the act of procreation by division of their parts, and the ultimate development of peculiar form to a definite extent only, and the organical arrangement of the several compounds of which the body consists, as strongly identify them with the vegetable kingdom.

The colourless pellicle which distinguishes many species of the zoophyta planta, and is also distinguishable in some of the stony species, is formed in every individual of the vegetable kingdom; the cellular texture is formed from the membranous in like manner, varying in form in different genera and species; the ligneous fibre is substituted by the stony matter, which supports and constitutes the solid part of the body, being also formed by a series of depositions, which, after the body has attained maturity, gradually encroach upon the vascular vessels, and, by arresting further circulation, destroy the vital principle. In like manner with vegetables, many species are permanently fixed upon bases, advancing in their growth towards the rays of the sun in the direction of light and heat, and this vegetative process is manifest, not only in the Zoophyta Planta, but also in numerous species secreting lime, as sea ferns, sponges, madrepores and millepores.

Many of the stony polyps, while in the living state, continue soft and yielding to the touch, but as the sap vessels fill up, they gradually indurate, and if this take place beneath the waters, they become converted into limestone rock: thus it is with the beautiful Meandrina spreading over its consolidated bases in moss-like clumps: its external covering is exceedingly soft, similating to the living sponge, and as it enlarges, so it enlarges on every side; its animal matter is converted into a kind of bony substance, which is filled with living juices passing to and fro through the whole system, until the entrance to the cellular pores becoming filled up, the lower portion dies, but still remains attached to the living body.

The time that each species requires to perfect its growth is very variable, necessarily depending upon latitude, dip, and inclination; and again, upon its preservation from those numerous accidents to which it is subject in common with all forms of life, such as local or general disturbance of the medium in which it is placed, or the predatory warfare urged against it by almost all the living species of the deep. An erroneous idea is entertained by men of science, that the stony polyps are of exceeding slow growth, such being the natural consequence of their consolidated nature: thus Ehrenberg calculates that the specimens of Meandrina seen by him in the Red Sea were at least 2000 years old; but these, it would appear, were of the dead and not of the living coral: and even if living, the calculation is ridiculous, for, in fact, they attain a very great size in 20 years when uninterrupted in their growth. In tropical regions, where they enjoy heat and quietude, their growth is exceedingly rapid, rivalling, in this respect, terrestrial plants and grasses; but like the latter they are the food of myriads of creatures which greedily crop off the flesh-like surface, and thus retard their growth. In the lower depths and beneath temperate climes, like the leaves of the forest, they die off annually, or, otherwise, their growth is retarded by adverse circumstances of low temperature and local disposition. Much also depends upon their freedom from tidal disturbance, for the tender and delicate gemma or buds of many species are easily washed away by the ocean tides, or destroyed by the intrusion of sands, or other matters inimical to their freedom of action or alien to their nature.

Some idea of the time required to mature their growth, may be derived from our knowledge of the growth of the white and red corals of commerce, in the Mediterranean Sea. Marsigli informs us that the white coral of this sea is most abundant in caverns to the south, and where the sea is smooth and tranquil; that it is seldom found in a western exposure, and never to the north; that when the caverns are despoiled of it, ten years are allowed by the fishers for its regeneration, and in this time it attains its extreme height and thickness; at greater depths it disappears. This is confirmed by Spaglanzani, who says that in the neighbourhood of San Stephano the coral does not attain half a foot in 10 years, and in proportion to its depth so it deteriorates in quality, and gradually disappears; that the greater quantities are at depths varying from 60 to 125 ft., and some fisheries are carried on to the depth of 900 ft.; at this latter depth it is said to require 40 years to attain the same size which, at the depth of 60 ft., it attains in 10 years. In all parts of the ocean, local influences determine the time requisite for maturing the coral. M. de Peysonnel found that the coral grows in different directions, sometimes perpendicularly downwards, sometimes horizontally, and sometimes upwards, and in the caverns of the sea open to every exposure. Lamouroux remarks, "we find some polypidoms placed always on the southern

slopes of rocks, and never to that towards the east, west, or north; others, on the contrary, grow only on those exposures, and never to the south. Sometimes the position is varied according to latitude, and the shores inclined towards the south, in temperate or cold countries, producing the same species as the northern exposures of equatorial regions." Again, it is evident that the duration of their existence is variable; some are but the creatures of an hour, of a few months, falling off and disappearing according to their nature, and to the climate to which they are subjected; thus in the colder seas, numerous tribes are cut off every winter to be renewed in spring. Some continually throw off their parts, and thus new generations are produced, and these gemmules being carried away by tidal action, or by attaching themselves to locomotive animals, cause such tribes to be more generally diffused. But although, as Lamouroux remarks, many species are periodically destroyed, it must not be supposed that entire destruction takes place. The matured portion of the compound body remaining, as a tree stripped of its leaves, being reclothed with verdure in the ensuing spring, and still adding to its strength and size by multiplication of its imperishable parts. In tropical countries, where the heat is general, the polyps spread abroad over the valleys and troughs of the deep, without reference to inclination, as in colder seas, their nature and qualities being determined by the temperature and depth.

The present accepted term of polype is much too vague and undefined to be rightly understood, being made to embrace many animals of higher organization; thus, according to the present acceptation of the term, every plant and every animal may be classed as polype—every organic body, whether it be animal or vegetable, increasing by the multiplication of its parts. The term polype ought, therefore, to be confined to those simple organic bodies which act independently in their parts and quantities, so that on separation, the several divisional parts, as in the hydræda and other species, they experience no loss of power in this division, but still continue their functional operations, being perfect results in their separate state, and perfect results as one whole. On the other hand, there are species of coral and corallines where life is in entirety as in shrubs, and some of these cannot be propagated by slips or cuttings.

Numerous species are, from their nature, confined to particular localities of the water, or to certain depths; others are generally, and some are universally, diffused, maintaining their form and qualities under every latitude; but with few exceptions, locality has a marked and determinate influence in their organic structure, and in their qualities and quantities, which almost invariably depend on food and temperature, in consonance with the known laws governing all animated nature, for beneath all latitudes like Causes produce like Effects; when the temperature and local and general action similate, the results similate also. Thus the stony corallines and corals abounding in eastern seas, are of similar conformation and character to those dwelling within western and southern seas; and thus it is in the uniformity of living species, there is a uniformity of matter produced by the functional operations of life, the depositions of matter forming strata composed of oceanic organic bodies and their decomposed particles, being the unerring indication of the temperature under which they lived and propagated in their generations. Thus the fixed or locomotive animals or animo-vegetables which secrete lime, and by deposition age upon age, form hills and mountain chains of calcareous matter and of solid limestone, (such, for instance, as much of the British strata is composed,) make us acquainted with the primary causes of effects produced, being unerring indications of the vast and wonderful changes which this planet has undergone, and which it must still undergo ere the end of nature is accomplished; such organic beings as are hourly manifested to us, having of necessity existed and propagated within a medium and beneath a temperature adapted to their habits and character; thus it is that every formation of chalk, oolite, ocean marl, and calcareous matter, however remote from those latitudes in the present day, however far removed, however high it may be elevated above the present level of the sea, however changed and disguised by time or circumstance, must, while generating and perpetuating their species, have been beneath tropical and quiet seas during those ages requisite for the completion of so vast a mausoleum.

The calcareous polyps, comparatively speaking, are scarcely known in the depths of northern seas; the delicate corallines are equally scarce in the depths of tropical seas, species being most abundant in latitudes where there is warmth and tranquility; all in their growth advance towards the rays of light and heat: but where the sun is nearly vertical, they extend themselves in every direction, without reference to latitude and dip. The sponges, sea mushrooms, millepores, and many species of madrepore, together with echini, sea worms, and numerous other species, are seldom found at any considerable depth, intense heat communicated through the shallow aqueous medium and refracted from the calcareous bed, being most favourable to the full development of many species, and essentially necessary to the existence of others. In proportion to the degree of heat, so is the quantity of lime, soda, magnesia, and other compounds.

To those who have seen the splendid collection of corals in the British Museum, I would observe, that in many of the beautiful specimens, such as Astrea and Meandrina, they behold the skeletons alone. The beautiful convolutions of the one, and the star-like appearance of the other, were once covered with their animo-vegetative covering, exhibiting varying colours, as green, blue, purple, white, &c.; the now empty cells were then replenished with living juices circulating throughout the compound body; the dendrophillia, sensitive to the slightest touch, contracted its beautiful flowery head; and Gorgonia, approaching nearest to terrestrial shrubs, interposing its dark twigs, gave relief and additional interest to the fairy scene, mimicking the fairest gardens of the earth; the sponge too, light and tremulous to the touch, was then filled with a thick viscid juice, and many species, now rigid as marble, while living, waved their branches to and fro as agitated by the tides, or by the passing monsters of the deep.

In all and through all, we find the link of animal and vegetable life to be so finely drawn as to prove inseparable; the nature of the material may differ, but the mechanical action of the one and of the other at all times assimilates, and in both we observe a beautifully graduated scale of life, from the simple spark or mere impulsation, to the most elegant and complicated form, from the simplicity of union of primary principles to the development of innumerable proximate principles and atomic compounds. Philosophic observers of polyps may discover in their elementary properties, actions, and sensibility to external impressions, identifying their animal organization, but the body formed is one body, and, in numerous genera, is governed by one influence; and in these, the act of the tentacula is extrinsical and involuntary; not depending on the will of matter placed within the cellular cavity, but upon the internal filament which passes through and connects the whole in place of nerves, or upon the vital fluid, whose action pervades the whole. It is of no real importance to man to be assured that the lethophyta and keratophyta are animal or vegetable; the great and important question is, what part do these minute developments of living action, fixed or locomotive, simply gelatinous, or converting into stone, perform in the economy of nature? From whence is derived the material of the animal or vegetable body? The important part they perform in giving increase to the earth and to the most ponderable bodies of which it is composed, is manifest at every step we tread, in every region of the waters; the simply gelatinous and albuminous animals attach themselves to every consolidated substance, and propagate like the grass of the field, thus ere the oyster has attained maturity, its calcareous covering becomes the basis of a world in miniature: the rock, the mineral body, and the ocean bed are concealed from observation by the incrustation of countless myriads; the waters teem with animalculæ, with numerous organic species, destroying, or becoming the prey of others: as local influences determine, so they propagate or are destroyed; and, favoured by heat and quietude, so they diverge into species, and exhibit new phenomena.

In my next I shall proceed to consider the importance of the lime secreting polyps in the economy of nature, and the results manifest in all parts of the earth.

H. G. M.

(To be continued.)

Life-Preservers at Sea.—Experiments have lately been made at Leith harbour on a newly-invented safety cape, which may be worn, and thus preserve a person from the danger of drowning in any depth of water; and likewise a pillow inflated with air. Two persons jumped into the sea thus protected, and exhibited several means of preserving the lives of shipwrecked mariners.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

April 11.—JOSHUA FIELD, V.P., in the Chair.—*(continued.)*

Screw Cutting.

Some specimens were exhibited of screws cut in lathes constructed by Messrs. Shanks and Co., of Johnstone, near Paisley. They were sent by the late Sir John Robison, who described the principal advantages of the arrangement of the lathe for cutting them to consist in the cutters acting during the incursion as well as the excursion of the slide, and when forming long screws, in their being alternately stayed on the side opposite to the tool which was in action; that by these means, good work could be produced with such dispatch, as to reduce the cost of turned screw bolts, as low as that of similar articles produced by screwing machines, which worked with dies acting by compression.

A drawing of the lathe used in cutting the screws was presented with the specimens.

Mr. Field observed that the machine was ingenious and appeared to do the work well; but as far as could be ascertained from the drawing there was not any novelty in it. A similar machine made by the late Mr. Maudslay, had been in use in Maudslay and Field's manufactory for the last 15 years. The screwing dies invented by Mr. Whitworth, cut out the threads of screws as clearly as if done by a chasing tool, and entirely without compression.

April 25 *and May* 2.—The PRESIDENT in the Chair.

"*An Account of the Brick-making at Blechingley Tunnel, during the winter of* 1840 *and summer of* 1841." By Frederick Walter Simms, M. Inst. C. E.

As the forming of this part of the Dover Railway was not let by contract, it was necessary to make extensive preparations previously to commencing the work, and amongst these the brick-making department was one of the principal, the whole being under the personal superintendence of the author. The bricks were all made on the surface along the line of the tunnel, the brick-grounds being so arranged on each side of the shafts, that when the bricks were delivered from the kilns and stacked, but little labour was necessary to convey them to the spot, whence they were lowered to the underground works. The mode of manufacture adopted was that of "slop-moulding," in which process the mould is dipped into water previous to its receiving the clay, instead of its being sanded as is the case in making sandstock bricks; the workman then throws the clay with some force into the mould, pressing it down with his hands to fill all the cavities, and strikes off the overplus with a stick; an attendant boy, who has previously placed another mould in a water trough by the side of the moulding table, takes the mould just filled, and carries it to the floor, where he carefully drops the brick from the mould on its flat side and leaves it to dry; by the time he has returned to the moulding table and deposited the empty mould in the water trough, the brick-maker will have filled the other mould, for the boy to convey to the floor where they are allowed to dry, and are then stacked in readiness for being burned in clamps or kilns. Minute details of the manufacture are then given, the average results of which are shown in the following table:—

Force employed.	Area of Land.		Duration of Season.	Produce per Week.	Produce per Season.
	Roods.	Prchs.	Weeks.	Bricks.	Bricks.
One moulder					
One temperer					
One wheeler		14½		16,100	354,200
One carrier boy ..					
One picker-up boy					

A careful comparison is then made between the two modes of sandstock and slop-moulding, from which it appears that while the production of sandstocks is as 30 to 16 of the slop process, the amount of labour is as 7 to 4, and that the quantity of land required and the cost of labour per thousand are nearly the same in both processes. The bricks were all burned in close kilns constructed with soft bricks set in pugged clay, the quantity burned in them at a time varying from 30,000 to 40,000. The fuel employed was that known by the name of the Bell Robson Netherton, or South Hartley coals, and for the purpose of more accurately determining the cost of this element, the author caused the quantity of coals consumed in burning 94 kilns of bricks to be carefully noted: this is given in a table accompanying the communication; the average of it is, that 10 cwt. 8 lb. of coal were used, in burning each thousand of bricks. The floor of the drying-houses was made of pugged clay about nine inches thick at the furnace end, and gradually diminishing to two inches at the extreme or chimney end, so as to equalize the heat of the floor. The temperature of the interior of these drying-houses when in full operation varied from 50° to 70° Fahrenheit. The estimated cost of the bricks delivered at the shafts was 2*l.* 1*s.* 10*d.* per thousand; but the actual cost, obtained by dividing the total expenditure by the whole number of bricks made, was only 2*l.* 1*s.* 6*d.* per thousand, which includes waste and all other expenses that were incurred.

The author notices the substitution of Mauritius sugar mats for the ordinary hack-caps made of straw, and that they were durable and serviceable.

The paper is accompanied by two drawings showing the elevations and sections of the kilns and drying-houses with their flues.

Remarks.—In answer to questions from several members, Mr. Simms stated that the price of moulding bricks by the slop process was 5*s.* per 1000; that slop bricks occupied less time in drying than sandstock bricks; that the former kind were full one pound each heavier than the latter, which he attributed to the greater amount of pressure they received when being moulded; for this reason also the sandstocks were made somewhat quicker. The price of the ordinary hack-caps made of straw was 4*d.* each, and they lasted one season; the Mauritius sugar mats which were substituted for them, cost about 1*d.* each and would last two seasons.

Mr. Bennett thought that the quantity of bricks which could be produced by each gang of men was under-rated, for, at Cowley, the average number of sandstocks moulded was 32,000 per week; while his men very frequently made 37,000, and sometimes they reached as far as 50,000. The space occupied for moulding at Blechingly appeared small; in Mr. Bennett's brick-ground 10 stools occupied 20 acres; this might arise in some degree from more time being allowed for drying in the sandstock process: he believed this to be an advantage; the principal part of the shrinkage took place while drying previously to being burnt. The total amount of contraction in his bricks was $\frac{18}{16}$ inch in 10 inches; but all clays differed in the amount of contraction.

Mr. Farey directed the attention of the meeting to Hunt's improvements on the Marquess of Tweeddale's machine for making bricks; it had not, he believed, yet been brought into general use in England, but it was employed extensively at Hamburgh and other places on the continent, and was stated to produce stronger and better shaped bricks, of more uniform quality than those made by hand moulding; the process was a kind of intermediate one between slop and sand-moulding; the moulds being wetted as in the former process, while the clay was tempered in a pug-mill as in the latter process.

A very ingenious system of moulding without wetting the clay had recently been introduced by Mr. Prosser of Birmingham. At present the system was confined to the production of buttons, small tiles, and slabs for painting; but the patentee asserted that the machine could be advantageously used in making bricks. A few had been made which in burning only shrunk $\frac{1}{80}$th of an inch in 9 inches.

Mr. Bennett said the Marquess of Tweeddale's machine had not been adopted generally, because of the first cost, and that the necessity for employing horse power, or a steam-engine, for working them, rendered the bricks more expensive than when made by hand.

Mr. Homersham stated that steam or horse-power was not indispensable; that Messrs. Simpson and Co. had made several of Hunt's machines for the Tweeddale Brick Company to be worked by manual labour, and that they succeeded perfectly. He found the bricks so produced about one-sixth stronger than those made by hand, which he attributed to the degree of pressure to which they were subjected.

Mr. Simms objected to the use of machinery chiefly because it would only effect an economy in the moulding, which was but a small part (about one-eighth) of the expense of making bricks.

The contraction of the bricks varied according to the nature of the clay employed: the moulds used at Blechingley were 10 inches long by 5 inches wide and 3 inches thick, and the bricks when burned were 9 inches long by 4¾ inches wide and 2¼ inches thick. The chemical constitution of different clays, and the relative proportions of alumine and silex contained in them, would be a subject of much interest and practical utility, to be brought before the Institution by some member possessing the necessary chemical knowledge.

Mr. Bennett mentioned the existence of a brick machine invented by Mr. Ainslie, and now working in Scotland; it was, he believed, somewhat cumbrous, and required to be driven by steam power, but he had understood that it produced very good bricks and tiles, but was chiefly employed to make the latter.

In answer to a question from the President, Mr. Simms said that the bricks at Blechingley had been made without any cavity in the top and bottom, in order not to waste the cement in which they were laid. Engineers entertained very opposite opinions as to the utility of the cavity in the bricks.

Mr. Cubitt preferred the bricks having a cavity, if they were to be laid in mortar; with cement it was of less importance.

Mr. Farey believed that when the cement was stronger than the bricks,

cavities on the surfaces were desirable, but if the bricks were good and stronger than the cement, the cavities were not necessary.

Mr. Farey exhibited specimens of tiles, &c., made by Mr. Prosser, of Birmingham, and described the process of manufacture. The clay was first dried upon a slip kiln as if for making pottery, then ground to a fine powder, and in that dry state it was subjected to heavy pressure in strong metal moulds: by this means it was reduced to about one-third of its original thickness, but the clay appeared to have contained sufficient moisture to give it cohesion, and the tiles retained the most perfect sharpness at the edges—they were then carried direct to the kiln, and baked in "saggers" or crucibles, without any previous drying, and they did not appear to crack in baking. A brick of the usual dimensions, which was exhibited, had been made by this process from the common brick-earth of Staffordshire, ground fine: it was of a clear red colour and of homogeneous texture, and the edges were sharp; its weight was 6¾ lb. and the specific gravity was 2·5.* Mr. Farey stated that this brick was not vitrified, but merely baked, and that it had acquired its density from the great pressure used, which was equal to 250 tons.

Mr. Pellatt had seen Mr. Prosser's machine at work, making buttons and other small objects; the ground clay appeared to retain a certain degree of moisture which, combined with the pressure, gave it such tenacity, that on leaving the mould it could be handled and carried direct to the kiln; it was compressed to about one-third of its original thickness.

The clay of the Staffordshire potteries contained chiefly silicate of alumine; it was principally valuable for, and was employed in, making "saggers" or crucibles wherein the china was baked. The clay from which the china and crockery-ware was made, was brought from Devonshire, Dorsetshire, and Cornwall, and was used with certain mixtures of silex and other substances according to the manufacture.

Mr. Blashfield stated that of the specimens of Prosser's manufacture on the table, the small hexagonal tile 3¼ inches diameter and three-eighths of an inch thick, had sustained a pressure of 30 tons, without the edges being crushed; another of the same diameter and 2¼ inches thick, bore 35 tons, and the 9 inch stock brick remained perfect under a pressure of 90 tons: the largest sized slab hitherto produced by the process was 34 inches long by 8 inches wide, and half an inch thick: but he believed that as soon as the new hydraulic presses were completed, it was Mr. Prosser's intention to make large bricks of varied forms for architectural purposes.

In reply to a question from the President, Mr. Cowper explained that the tiles, &c., after being subjected to the pressure, were released by the action of a treddle, which raised the bottom of the mould, and thus brought out the object without injuring its edges.

Mr. Hunt exhibited a model of the brick-making machine (see *Journal* for June last, p. 202) used by him, and described its construction and action. The principal working parts consisted of two cylinders, each covered by an endless web, and so placed as to form the front and back of a hopper, the two sides being iron plates, placed so that when it was filled with tempered clay from the pug-mill, the lower part of the hopper, and consequently the mass of clay within it, had exactly the dimensions of a brick; beneath the hopper, an endless chain traversed simultaneously with the rotation of the cylinders; the pallet boards were laid at given intervals upon the chain, and being thus placed under the hopper and the clay brought down with a slight pressure, a frame with a wire stretched across it, was projected through the mass of clay, cutting off exactly the required thickness of the brick, which was removed at the same moment by the forward movement of the endless chain; this operation was repeated each time that a pallet board came under the hopper. Mr. Hunt stated that the chief object of the machine, which was worked by hand, was to produce good square compact bricks, of uniform quality, using only a slight pressure. He had found that it was very difficult to dry bricks made by machinery where considerable pressure was employed; because, before the evaporation from the centre of the clay was completed, the surfaces were overdried and they frequently scaled off. These machines were in operation in several parts of England, producing usually about 1200 bricks per hour, and each machine required two men and three boys to feed it, turn it, and to take off the bricks; the clot moulders were dispensed with, and all the persons employed were common labourers; professed brick-makers were thus not required; he found this of much importance in the contracts which he had taken for making bricks, both in this and in foreign countries.

The machine for making tiles (*Journal* for June, p. 202, Fig. 2) is on the same principle as Fig. 1; it consists of two iron cylinders, round which webs or bands of cloth revolve; by this means the clay is pressed into a slab of uniform thickness, without adhering to the cylinders. It is then carried over a covered wheel, curved on the rim, which gives the tile the necessary form; the tiles are polished and finished by passing through three iron moulds of a horse-shoe form, shown in the centre of the cut; they are at the same time moistened from a cistern placed above them. The tiles are then cut off, to such lengths as may be required, and carried away by an endless web, and are placed by boys on the drying shelves. Flat tiles, or soles, are formed in nearly the same manner, being divided into two portions while passing through the moulds; the quantity of clay used for one draining tile being the same as for two soles. In answer to questions from the President, he stated that the density of the bricks could be augmented, but in that case, the time required for drying them must be increased, and frequently artificial means were resorted to, which rendered them more expensive.

Captain Buller inquired whether any advantage was obtained by the production of bricks of such a density as that exhibited by Mr. Prosser; whether builders would not consider them objectionable from their great weight, the difficulty of handling and cutting them, and the increased expense of carriage. He had understood that the lightness of the London bricks, which was chiefly owing to the ashes used in their composition, was considered an advantage, and that they were sufficiently strong for all building purposes.

Mr. Parkes was of opinion that the weight of Prosser's compressed bricks would be objectionable for ordinary purposes, and he did not think that the mortar generally used would adhere to such smooth surfaces as they possessed. The Roman bricks were very dense, but they were small in proportion, and they were used with mortar or cement which had been carefully prepared for a long period before it was used. The Dutch clinkers, which were so very durable, were small in proportion with their density; and the same might be observed of all foreign bricks, some of which were made with great care; for ordinary work he should prefer a brick of a less dense quality than the compressed ones.

Mr. Blashfield explained that Mr. Prosser's bricks could be rendered lighter, by an admixture of ashes or other substances with the clay, if it was considered desirable.

Mr. Newton had recently examined a wall which had been built with very dense bricks, and had twice fallen; the bricks appeared to have absorbed the moisture from the mortar, before it could adhere to their surfaces. He promised to exhibit on a future occasion, some bricks which were brought from the pyramids of Egypt; they appeared to be composed of sand mixed with chopped straw, and had not much cohesion; yet they were strong enough for the construction of such massive buildings as the pyramids.

Mr. Hunt said that engineers generally preferred dense bricks as their works required strength; he had found it advantageous to use mild clay instead of a stronger quality, as compact bricks made from the former, when well-tempered, were better than those of the same density made from the latter.

Mr. Fowler said that the value of bricks depended upon their strength: but he doubted whether density and strength were in this case synonymous; and he thought that bricks of a cellular structure would not only be stronger, but would unite better with the mortar. He thought, however, that Mr. Hunt's machine would prove advantageous, as the bricks produced by it would be of more uniform character than those made by hand moulding.

Mr. Pellatt believed that light bricks were generally porous, and that when they were used for building external walls the moisture soon penetrated; this was not the case with dense bricks, and if they were generally made more compact, thin walls would resist damp as well as thick ones.

Mr. Cowper believed that for architectural purposes so much density was not absolutely necessary. Houses three stories high had been constructed by the mode of building called "Pisa" work, which was merely ramming down tempered clay into moulds of the thickness of the walls, and allowing the mass to be dried by the sun as the work proceeded. In countries where the climate was very dry this method succeeded perfectly.

Mr. Braithwaite understood that several kinds of brick were made for the London market, that they were devoted to different uses and were sold at various prices; some qualities were capable of supporting a great amount of pressure, and were generally used with cement, while others were almost rotten.

Mr. Bennett said that the principal varieties of bricks were called "malm paviors," "stocks," "grizzles," "places," and "shuffs"; for the first kind the clay was washed and selected with care: the bricks so produced were of superior quality. The other kinds were all made from the same clay merely tempered, the difference between the sorts being produced entirely in burning them; common stocks were good enough for all ordinary building purposes; but the inferior qualities could not be trusted for important works. As to the relative prices of the several sorts, the difference between malm paviors and stocks was 15*s.* or 20*s.* per 1000; between stocks and places 10*s.*; the grizzles obtained a price midway between the two last named, and the shuffs were sold for an inferior price governed by their quality, as they were frequently quite rotten.

Mr. Lowe inquired what object there was in the mixture of "breeze" or ashes, with the clay for making bricks; was it intended to render them less dense, or to assist the combustion, when in the clamp or the kiln?

Mr. Bennett believed that the principal advantage of using a mixture of ashes with the clay was, that it rendered the combustion more regular, when the bricks were burned in open clamps; the sifted breeze was employed for fuel instead of coal, which would otherwise be used for burning in close kilns.

Mr. Hunt explained that the method of making bricks in the vicinity of

* The average weight of Hunt's machine-made bricks is 6 lb. 7 oz., and of Cowley Stocks, 5 lb. 5 oz.

London, differed from that of almost all other places, because the material employed was not pure clay; it was a substance nearly resembling loam, of a slightly cohesive nature, which would not admit of its being used in the natural state and burned in close kilns with coal, but that with an admixture of ashes it became sufficiently tenacious to be formed into bricks; the ashes performing the same office as the chopped straw did, in those made by the ancient Egyptians. Of the sixteen hundred millions of bricks made annually in England and Wales, about one-fifth part only was made according to the London method, with a mixture of ashes. As to the density, he did not think that the weight of bricks should be received as an index of their quality; for bricks made by exactly the same process and equally compact, would be heavier or lighter, as they were made of strong or of mild clay, and yet their strength would be equal.

Mr. Pellatt observed that nearly if not all argillaceous or aluminous earths were, with certain modifications or admixtures, suited for making bricks. The term silicate of alumine, might include the various earths, whether denominated clay, marl, loam, argile, &c. The best fire bricks were made from native clay, containing alumine combined with a large proportion of silex. The cohesive or plastic property arose from the former, but too much of it rendered the bricks fusible. As most of the common clays contained a large proportion of alumine, with occasionally lime or other fusible substances, a mixture of coarsely pulverised burnt clay, sand or cinders, became necessary, in order to counteract that tendency. Alumine had a great affinity for silex, as well as iron and sulphuric acid, and the large use of cinders as a mixture with the London clay might be accounted for, not only as it reduced the proportion of alumine to other substances, but because it had a tendency, when submitted to heat, to carbonize the sulphates, and to diminish the fusibility of the brick. Bricks made of common clay could not be burnt under the same high temperature as fire bricks, and they contracted much more in burning. All dry substances, which were used to decrease the proportion of alumine, in making bricks or crucibles, were included by the French under the general term of "ciment." The most useful properties of "ciment," when well pugged or kneaded with the clay, were to hasten the drying, and to diminish the contraction, and the consequent risk of breaking in the kiln: the addition of "ciment" was economical for fire bricks, particularly when they were manufactured at a distance from the mines; the fire clays of Stourbridge, Newcastle, and Glasgow, were found amidst the coal strata; Stourbridge clay was the most esteemed, and when carefully picked, ground, sifted, &c., would bear, for brick-making, two proportions (by weight) of burnt clay or "ciment" to one of native clay. The sagger clay from the Staffordshire potteries was also a fire clay, and was well suited for making tiles or bricks of a compact character, but was probably more liable to be vitrified than the Stourbridge clay. China clay, or the "kaolin" of the Chinese, was decomposed felspar, called in the potteries "Cornwall stone;" the undecomposed felspar was interposed with it, and used by the French and the Chinese as porcelain glaze, the term used for it by the latter was "petuntse." The constituents of "kaolin" were—

According to Dr. Ure.		Murray quoted Vauquelin's analysis—		Murray stated Vauquelin's analysis of Hessian Clay to be	
Silica.. ..	52	Silex ..	74	Silex	69
Alumina ..	47	Alumina	16·5	Alumina ..	21·5
Oxide of iron	0·33	Lime ..	2	Charcoal ..	1
		Water ..	7	Oxide of iron	8

Mr. Parkes believed that in addition to the ashes giving a cohesive character to the material of which the bricks were composed, they were of advantage in the process of burning, because they enabled the fire to spread gradually from the lower tiers, through the mass in the kiln, without permitting an intense partial heat, such as sometimes occurred where coal alone was used, the effect of which was, that all the bricks around were vitrified and their surfaces became glazed. He had given some attention to the subject, and had tried experiments, by ascertaining accurately the quantities of ashes and of water which were incorporated with the loam in a certain number of bricks, and had found that the evaporation, during the process of burning, exceeded that of any steam boiler, as it amounted to as much as 14 lb. of water by 1 lb. of breeze. The mode of making bricks near London was peculiar to the district, and the workmen did not understand any other method; the blue clay was not used because they did not know how to work it. In a work published by Mr. Aikin,[1] which was a selection from the papers read before the Society of Arts, the subjects of brickmaking and pottery were very correctly treated.

Mr. Dickinson observed, that the ashes used in making stock bricks, could not supply the place of the straw now discovered in the Egyptian bricks, because the process of burning would have destroyed the straw as it appeared to do the ashes; he had burned bricks extensively in clamps and in kilns, and it appeared to him that the ashes assisted in fluxing the brick earth, for on breaking a good stock brick it was always found that the interior appeared to be vitrified, and was extremely hard, and he remarked, that if the ashes worked in with the clay in pugging, either exceeded or fell short of the ascertained proper quantity, the bricks were fragile and less durable.

May 9.—The President in the Chair.

"*Observations on the periodical drainage and replenishment of the subterraneous reservoir in the chalk basin of London.*" Continuation of the paper read at the Institution, May 31st, 1842.[2] By the Rev. J. C. Clutterbuck, M.A.

The author commences by answering an objection founded upon a passage of Conybeare and Phillips' Geology (Book 1, chap. IV. sec. 11) which was urged against his former statements. The water, it was said, appeared to rise in different places to different heights—at Mile End it stood at the level of high-water mark in the Thames; at Tottenham 60 ft.; at Epping 314 ft.; and at Hunter's Hall, two miles beyond Epping, at 190 ft. above that level. Especial stress was laid on the height to which the water was supposed to have risen in the well at Epping, namely, to within 26 ft. of the surface, and to 314 ft. above high-water mark. It appeared from a note appended to the statement referred to, that the first 27 ft. from the surface of this well consisted of gravel, loam, and yellow clay, and that after sinking 200 ft. and boring 220 ft., as no water was found, it was considered a hopeless labour, the boring was discontinued, and the well covered over; that at the end of five months, it was found that the water had risen to within 26 ft. of the surface; from which it might be inferred, as was afterwards proved, by information obtained from the owner of the well, that this supply of water was to be attributed to a landspring, and was not derived from the sand of the plastic clay formation, to which the boring had not penetrated. Having thus answered this objection, it is shown that a line drawn from the water level at Hunter's Hall to mean tide level in the Thames, 10 ft. below high-water mark, would cut the level in the other wells, and give a water level dipping at an average inclination, very nearly coinciding with that insisted on in the statement to which the objection was raised. It appeared that the difficulty of determining the exact dip of the water level between the river Colne and London, had in some measure been removed, by the sinking of three wells in the direct line of the author's observations, namely, from the river Colne one mile N.E. of Watford, in a straight line to Edgware, and thence by the high road to London; the information thus obtained, proved the general correctness of the author's former calculation as to the line that would represent the natural water level. It is then shown that a line drawn from a point three miles south of the Colne, at the level of that river, or 170 ft. above Trinity high-water mark, to mean tide level in the Thames below London Bridge (a dip of about 180 ft. in 14 miles, or an average inclination of 13 ft. in the mile) cuts the water level at the point whence it is drawn, at Hendon Union Workhouse, and at Cricklewood, between that place and Kilburn, whence it may be inferred that up to this point there is no apparent trace of a depression of level caused by the exhaustion of water under London.[3] At Kilburn, the water level (which is known to have stood some years since about 20 ft. higher than at present) is considerably depressed below the line so drawn, which depression may be attributed to the influence of the London pumping—it is suggested, that it is desirable that the wells on the confines of London, and throughout the district, should be periodically measured, to ascertain at what distance, and in which direction this yearly increasing depression may be found to extend. The author proceeds to describe a phenomenon connected with the periodical replenishment of that portion of the London basin which underlies the London and plastic clays, and which cannot, as in the upper or chalk district, be fed by infiltration. This phenomenon is by him called the "oscillations of the water level," caused by the irruption of rain water, which runs from the surface of the London and plastic clays, and which sinks into the subjacent chalk through "swallow holes," on its arrival at the outcrop of the sand of the plastic clay formation. This point of irruption lies to the southward of the river Colne, and forms the line of demarcation between the clay and chalk portions of the surface of the London basin, leaving a belt of the latter varying from two to three miles, or more, in width, between the river and the outcrop of the clays. The water level rises to a point within the outcrop (called the fixed summit level) at an angle of not less than 10 ft. in the mile, when most depressed by the springs; below an angle fixed on as the lowest line of inclination to which the water in the chalk will fall. From the fixed summit the level declines towards London; in the line taken, it is found at the level of the Colne, three miles from the river. After heavy rains, when the clays throw the water from their surface, the irruption of water may be seen at the outcrop of the sand of the plastic clay formation;

[1] "Illustrations of Arts and Manufactures," by Arthur Aikin, p. 17, 12mo. London, 1841. The paper, with additions, was published in the *Journal* for October, 1841, vol. iv. p. 340.

[2] Minutes of Proceedings, *Journal* vol. V. page 385.

[3] The surface levels on this line having been obtained, and a section having been made, the line drawn from the two points, namely, three miles south of the Colne, to mean tide level in the Thames, enabled the author to determine the height to which the water was found to rise at Hendon Union Workhouse and at Cricklewood (the only points at which the height of water could be ascertained) in both cases to within three feet.

the level will then be raised in proportion to the quantity of water which passes through the sand into the chalk beneath it, the elevation of level extending towards the river in a ratio increasing with the distance from the river; the fixed summit will remain unaltered, until the level at the point of irruption has attained an elevation at which the water can flow towards the south. After a period of protracted drought the level will decline in the same ratio as it had risen, until it assumes a line in which little or no variation can be traced. In a given line from the Colne at Watford, to the village of Bushey, 1½ miles distant, in the autumn of 1841, the level was found to rise from the river, at a regular inclination, to a point within the outcrop of the clays. After heavy rains, the level, near the swallow-hole which receives a large body of water, began to rise rapidly, the fixed summit level not being affected till the level, at the point of irruption, rose above it; the total rise at the point of irruption was 20 ft., and at the fixed summit 2 ft. The position of the summit level had then varied from the fixed summit to the point of irruption; coincidentally with this elevation the level under London rose also, and began to decline at the same time that the level, at the point of irruption, sank below the fixed summit. The subsidence of the level at the point of irruption, was—in April, 4 ft.; May, 3 ft.; June, 2 ft.; July, 1 ft.; August, 9 in.; September, 6 in.; in October, and to November 8th, 1½ in.; the average inclination, from the fixed summit to the river, then being about 15 ft. in the mile. The subsidence of the level to this inclination, was coincident with a visible defalcation in the product of the springs discharging themselves into the river Colne. In the autumn of 1842, and in the preceding spring, similar effects were observed, both as to the rising of the level at the point of irruption, and the coincident elevation of the level under London. This oscillation of level has been traced at various points, both to the east and west of that here described. It is probable that near the junction of the Colne and the Ver, the level dips directly from the level of the latter river, at a point where the plastic clay extends itself under the Colne to the margin of the Ver. This suggests the probability of that to which the author alluded in his former communication—namely, the possibility of connecting a periodical defalcation observed in the waters of the Ver or the Colne, at those seasons when the water is short, with the exhaustion of water under London. The evidence in favour of this supposition has been strengthened, during the past year, by a repeated coincidence of variation in the London level with the supply of water in the river. The height of the water in the river (about 210 ft. above Trinity high-water mark) gives the same average inclination of level towards London as observed in other places, and strengthens the probability that the supply of water to the river may be affected at this point by the London pumping, the daily increasing demand of which will, if (as is contended) there be any ground for this supposition, very soon put this question beyond a doubt.

Remarks.—Mr. Dickinson said, that Mr. Clutterbuck's observations had been caused by a project for obtaining a supply of water for the metropolis, from wells to be sunk in the valley of the Colne. It had been stated, in support of the plan, that the rapidity with which the rain water percolated into the bowels of the earth, in a great measure prevented evaporation, and hence it might be assumed, that the quantity which descended upon the surface of the chalk found its way, with very slight diminution, into the fissures below. This reasoning was not in accordance with the deductions Mr. Dickinson had drawn from an extended series of observations, and, fearing that his mill property might be injured by the diminution of the supply of water, he had opposed the project. He had found it necessary, several years since, to investigate strictly the nature and extent of the supply of water to the springs and rivers of the chalk district, for which purpose he had a common rain gauge, which was corrected by observations upon that kept in the same district by the Grand Junction Canal Company; he also fixed a rain gauge on the principle suggested by Mr. Dalton, which demonstrated the quantity or proportion of the rain falling on the surface, which descended so far into the earth as to be beyond the reach of evaporation, and, therefore, must be calculated to reach the internal reservoir of the country whence the springs were fed. This gauge demonstrated that the greater part of the rain that fell on the surface, was either consumed by vegetation or evaporated. It furnished information of the most valuable kind, both as regarded his mills and business, and as to any engineering operations, having reference to the perennial supply of water in the springs and rivers of the district. Mr. Dickinson presented a tabular statement of the comparative result of his two gauges for the last eight years, pointing out, as was generally the case, that none of the rain-water penetrated to the springs between the 1st of April and the 30th of September. He also stated that the indications of the gauge were not only certain, but that they preceded generally by about two months, any thing that could be deduced from the observation of wells, with reference to the effect upon the rivers; and that, as to the latter, the only guidance to be derived from the state of the wells, was from those in the higher range of the chalk, because, along the valleys where the streams flowed, the level of the wells continued nearly the same throughout the year.

Mr. Clutterbuck perfectly agreed with Mr. Dickinson as to the satisfactory results yielded by Dalton's rain-gauge; but he had, from the first, expressed an opinion, that the same practical results might be obtained by a periodical measurement of the wells, in any part of the chalk district. If a line was taken, extending from the river or vent to a point midway between the rivers Gade and Ver, or any others, and observations made during different periods of the year, and the same periods of different years, the height to which the water rose or fell, would indicate the quantity which had actually percolated to the water level, and would give the relative quantity to be delivered out by the springs. The ratio of alternation throughout the line would be maintained with such undeviating regularity, that by the measurement of the wells at the two extremes, the rise or fall of all between them might be calculated with the greatest exactness. He had chosen, by way of illustration, a portion of the line, of which a section, three miles in length, was given, extending in a direction north and south between the rivers Gade and Ver, a locality whence a considerable portion of the water, which in part moved the machinery at Mr. Dickinson's mills, was derived. He took the seasons which govern the supply of water, as shown by Dalton's gauge. In the season 1840-41, the gauge indicated the percolation of less than 5 in. of rain, a quantity which must be far short of that which found its way to the water level. The gauge recorded no percolation of water immediately after the melting of the snow on the 16th of January, 1841, within a month of which time the level rose in some localities more than 15 ft. To make a proper estimate of the quantity of water to be delivered from the springs, it was necessary to ascertain the state of the level before the percolation commenced; to this the rain gauge was no guide; but by Mr. Clutterbuck's observations he was enabled to determine the exact relative depression of the level. The first day taken was September 13th, 1841, between which period and November 8th, the level rose at one point 18 ft., and at other points in due proportion, which distinctly proved that "the indications of the rain-gauge do not precede by two months any thing that can be deduced from observations on wells." His next observation was February 14th, 1842, showing the highest point at which he measured the level, giving a total rise of 34 ft.; though from observations elsewhere it must previously have risen even higher, and have fallen to that point in consequence of the accelerated drainage caused by the breaking out of springs at higher levels, when the water in the chalk attained a certain elevation. On the 7th of May the level had fallen considerably, and on the 24th of October had declined to within a few inches of the same level as in the September of the previous year. In the season 1841-42, Dalton's gauge indicated the percolation of 17·98 in. of rain; in 1842-43, 10·64 in.; but from the causes before alluded to, and from the rain not having percolated till a later period, the level continued to rise till May, consequently the quantity of water then in the chalk was greater in proportion, than as 10 to 17. He conceived that the great practical question was, what supply might be reckoned upon from the 1st of May to the end of October? The reply to this was, he contended, more distinctly given by his observations than by the indications of Dalton's rain gauge. With reference to the rapidity with which the water found its way from the surface to the level, except when there was a great quantity of rain within a very short period, the percolation would be gradual, as indicated by a steady and progressive rise in the wells, which he had ascertained to amount sometimes to 1 or 2 in. in a day in the upper district, and continued generally to the beginning of May. In the neighbourhood of the swallow-holes the level rose very rapidly: a well sunk 50 ft. in the chalk, in which the water stood at 40 ft. from the surface, was affected within 15 hours after a late heavy rain commenced; the quantity of rain, which amounted to 1 in. in 12 hours, appeared to have retarded by a fortnight the exhaustion of that portion of the level to the south of the Colne, which is fed by the irruption of water through the swallow holes. On a former occasion, between the 10th and 25th of November, 1842, there fell on the surface 3·88 in. of rain; the level near the swallow-holes rose 6 ft. within the same space of time. When the water had reached the level, the influence of one part on another was very rapid: thus when the distant level was raised, as Mr. Clutterbuck had described, there was a simultaneous rising of the level under London. The continuity of the level, as shown in his section, was the best evidence in favour of the supposition, that the water to London was mainly supplied from the source to which he had attributed it. He had not met with any evidence in favour of the supposition that a distinction was to be drawn between the water from the chalk and that from the sand; he believed that it was all derived from the chalk, whence it rose into the sand, to which there appeared no impediment. At the points where the water broke through the sand, it invariably sunk into the subjacent chalk, a space being left between the bottom of the sand and the top of the water; following the water level, it might be traced in the chalk, and rose into the sand when the surface of the chalk sunk below the inclination at which the water level dipped towards London: from whence he inferred that the whole level of water might be called the "Chalk water level."

Mr. Simpson reiterated his opinion respecting the waters in the sand and in the chalk being different. He had seldom found the water from those strata stand at the same level, and in the majority of instances, the water from the chalk rose to higher levels than that from the sand. Towards the west of London, prior to 1830, there were numerous cases of overflows from bore-holes; and he believed, from an account drawn up by him from actual inspection of the wells when they were sunk, or soon afterwards, and which he presented to the Institution, it would be found that in the majority of instances of overflowing wells the water proceeded from the chalk. This paper gave an account of 67 wells, detailing in several cases the various strata passed through, and in all, the total depth, the levels at which the different qualities of water were met with, the quantity of water yielded, and the height to which the main supply rose in the well. He had found from recent inquiries, that in many of these wells the water had now ceased

to overflow. It would appear that as the number of wells and bore-holes had increased in some districts, the water levels had been depressed; in several cases, the cause of this had been traced to wells which had been bored at extremely low levels, and in others to the increased pumping.

Messrs. Worsencroft and Brothwood, of Hammersmith, who practised well-sinking extensively some years since, were most successful in wells where their competitors had ceased working when they had pierced some distance into the sand strata, whence the water only rose to some distance beneath the surface; but by continuing the boring down into the chalk, they obtained overflowing wells.

Mr. Scanlan said that the difference between the water from the two strata was easily discovered by analysis: the water from the sand contained common salt and no lime, while that from the chalk contained lime and no common salt.

Mr. Clutterbuck said, in answer to Mr. Simpson's objection as to the identity of the chalk and sand water levels, the disparity of level that he spoke of, occurred in localities where there was an exhaustion by over-flowing Artesian fountains, in which case a discharge of water was created below its natural level, which would cause the same kind of depression either in the sand or the chalk, as that which was caused by pumping the same quantity of water from a corresponding level where the water would not flow above the surface; the only difference being, that in the former the depression was permanent, and in the latter it was coincident with the temporary exhaustion of the pumps. As the water was discharged from the Artesian fountains more rapidly than it rose through the sand from the chalk, a permanent depression took place in the wells sunk into the sand, whilst a lesser depression occurred in the chalk, and thus caused a disparity of level. Thus the water level, in the wells sunk into the sand in London, was temporarily depressed by pumping from others in the neighbourhood, and the level was regained when the pumping ceased.

Mr. Braithwaite eulogized the industry and observation of Mr. Clutterbuck, and he hoped that he would extend his investigations to the point of the outcrop of the basin of the river Thames, which he had stated to be near Woolwich. He must, however, dissent from the author's views as to the supply of water to the sand under the plastic clay, being derived from the chalk, and also, that if no rain fell during a period of three years, the water in the wells referred to in the section, would retain their relative levels, at an inclination of not less than 10 ft. in a mile. He believed that any continuation of dry weather, which would affect the land springs, would also diminish the filtration, and the upper part of the basin on all sides would be affected before the greater depths. He also differed from Mr. Simpson as to the supply for the overflowing wells at Kingston, Mitcham, and other parts, being from the chalk; on the contrary, he was of opinion that it proceeded from the sand under the plastic clay, and he instanced Mr. Palmer's well at Kingston, and that sunk by Mr. Clark at the Kingston Union. The latter well was within 100 yards from the former: it was 120 ft. deep to the sand spring, and the water rose to within 7 ft. from the surface. While the water stood at this level in the well at the Union, it overflowed at Mr. Palmer's; but when the level at the Union was reduced by pumping to 20 ft. from the surface, the water at Mr. Palmer's well ceased to overflow: thus, he contended, establishing the fact that the water in both wells was derived from the sand, and not from the chalk.

Mr. Clutterbuck observed that the reason why there was a depression observable at Kilburn, and not at Cricklewood, was easily explained, if the depression caused by pumping in London was laid down on a diagram. In the centre of London the depression amounted to 50 ft. below Trinity high-water mark; at the Hampstead Road, to 38 ft.; and at the Zoological Gardens, to 25 ft. This line, if produced, would show a depression below the natural water level at Kilburn, and fall into the non-depressed level about Cricklewood. Though it was impossible to prove the assertion, that the water level in the chalk would never assume a less inclination than 10 ft. in the mile, he was led to the supposition by observing that the level ceased to decline when it became depressed to that extent; and many wells at a distance from the vent, which at the time of such depression cointained only 3 ft. of water, were never known to become dry.

Mr. Clark stated that he had found the water rise from the chalk to very different levels in the various wells and bore-holes which he had sunk, and he had not observed that the supply of water was affected so immediately after rain as had been described by Mr. Clutterbuck. He presented a paper containing memoranda relative to wells sunk and bored for a considerable distance on both sides of the river Thames. This document gave the depths at which the chalk was arrived at and the water was found, and the height at which it stood in several wells round London. It stated also, that in London the average depth to the chalk was 220 ft.; that the water generally rose to within 70 ft. of the surface, but that near the river it rose to within 50 ft. In some particular cases, such as the Lunatic Asylum at Wandsworth, the depth to the chalk was 323 ft., yet the water rose to within 30 ft. of the surface.

Mr. Davison presented a copy of a drawing made in the year 1822, showing the depth of sinking and of boring, and the height to which the water rose, in ten of the principal wells in London at that period, which it was remarkable was exactly Trinity high-water mark. It appeared also that the water did not now rise in the same wells to within 50 ft. of that point, showing a depression of nearly 2 ft. per annum.[1]

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Thirteenth Meeting, 1843.—*Held at Cork.*

(From the *Athenæum.*)

(Continued from page 324.)

Tidal Observations on the Firth of Forth, and of the East Coast of Scotland.

Mr. Scott Russell read the concluding "*Report of a series of Observations on the Tides of the Firth of Forth and of the East Coast of Scotland,*" noticed in last month's *Journal.*

These observations extended over several seasons, and no complete report had been hitherto presented, as the observations of each former season had only shown the necessity of further extending the observations. The observations of the first season had proved the existence of certain anomalous tides, which had not formerly been accurately examined, and proved that these anomalies were more extensive than was at first conceived. Next season the observations were more widely extended, so as to comprise the whole phenomena, including many adjacent places, to which the same anomalies were traced; and thus the general nature and extent of the phenomena were determined with accuracy and precision, and reported to the last meeting. But it was found that great differences of opinion existed with reference to the cause of these ascertained phenomena, and rendered it obvious that the observations required to be extended still further, in time and extent, in order to settle conclusively the questions which had arisen out of the former inquiries. But this last series, from their extent and completeness, had now been so fully examined and discussed, as to afford ample means of deciding on the nature of the phenomena, and determining their origin. Simultaneous observations had been made at nearly twenty stations on the east of Scotland, from Newcastle and Shields to Inverness, and as many as 2000 observations a-day registered and discussed. The results of these were exhibited in the tables and diagrams accompanying the report: and the result of the whole had been to elucidate, in a remarkable manner, the mechanism which propagates along our shores and rivers the great ocean wave, which carries from one place to another the successive phenomena of the tides—in such a manner as could not have been attained by any system of observation less extensive than that which had been adopted. It is pretty generally known that the phenomena of the tides with reference to their generating cause, the influence of the mass of the sun and of the moon in the various relations of distance and direction of these luminaries, have recently been examined with great success, in a series of researches carried on, first by Mr. Lubbock and then by Mr. Whewell, partly with the co-operation of this society. By means of their labours we are now enabled to predict, with unlooked-for accuracy, the time of high water, and the height of the tide in many of the harbours of Great Britain. But many of the local phenomena of tides remained unaccounted for, and these had been the object of a special series of researches, of which the present formed a part; the object being to determine in what way the conformation of the shores, and of the bottom of the sea, and the forms of the channels of rivers and friths, affect the phenomena of the tidal wave. The rivers Dee and Clyde had been formerly examined with this view. To these were now added the Forth, the Tay, and the Tyne, and the northern shores of the German Ocean. The manner in which these observations were conducted, is not the usual one, of noting down simply the hour at which high water occurs, and then the hour of low water, along with the height at which the water stands at these times. Such a method had been found quite inadequate to the purposes for which such observations are required, and, indeed, he thought it of importance that all tide observations should, if possible, be made in the manner he was now about to describe, especially all tide observations made for scientific purposes. This plan was, to carry on simultaneously at the places examined, a series of continuous observations, every five minutes night and day, by successive observers, without intermission, for the period of a month, or of several months, as might be required. Printed forms were sent to all the stations, and in them, the observers simply noted down every five minutes, the height of the tide on a graduated scale placed before him.

[1] In a letter to the Secretary of the Institution, dated April 28, 1843, Dr. Buckland says, "I think that Mr. Clutterbuck has added many new facts in confirmation of the theory he maintained last year, as deduced from his observations previous that time. He has also, I think, found a satisfactory solution of the apparent anomaly afforded by the well at Epping. I consider the series of observations he has been making near Watford, to be very important as throwing light on the movement of the subterraneous sheets of water which supply springs and rivers. I believe these observations to be correct, as I know that he has been indefatigable in collecting facts, and I consider them calculated to illustrate a problem of high interest to civil engineers as well as to geologists."

Every day at noon all these papers were sent by post to the central station, and immediately on their arrival, the papers of the different stations were compared, and their observations laid down on paper, so as to give a graphical representation to the eye of all the observations, by means of which, they were at once verified and compared with great facility. From the examination of these tide-waves thus laid down, certain characters of the tide-wave peculiar to each locality had been discovered. As in the former observations of the Clyde and the Dee, it had been found in this series, that the form and dimensions of a channel produce important changes in the form of the tide-wave. Where the sea was deep and the shore open and abrupt, the form of the tide-wave was symmetrical, and of the form predicted by Laplace, where he says, that in rising and falling, the water covers in equal times equal arcs of a vertical circle. This is the form of the ocean tide-wave; but, on approaching a shallow shore, and travelling along a shelving coast, the tide-wave undergoes two changes—its summit becomes displaced forwards in time, its horizontal chords become dislocated, and the wave ceases to be symmetrical. This peculiar dislocation and displacement are characteristic of a littoral tide, and in the case of running streams, the currents still further affect the tide-wave, and give to it a peculiar distortion characteristic of fluvial tides. To these were further added the exaggeration and elevation of the tide, by means of narrow channels. All these phenomena were fully proved by the present series of observations. The author of this paper also considers it to have been fully established by the observations on the Firth of Forth, that there exists on the eastern coast, satisfactory evidence of the presence of a second tide-wave in that part of the German Ocean, and that the southern tide-wave, a day older than the northern tide-wave, sensibly affects the phenomena of that part of the coast. To this he attributes the double tides of the Firth of Forth, the nature of which he fully explained. Regarding these double tides, various theories had been formed—and there were various ways in which such tides might happen, whenever tide-waves arrive by different paths in different times. But this kind of double tide was, in this case, only to be explained by the method he had adopted, and which removed the difficulties in which the subject had formerly been involved. He then proceeded to explain the mode of discussion which had been adopted. It was the semi-diurnal inequality, so accurately examined by Mr. Whewell, which enabled us to decide on the ages of two tides. If the two tides which appeared together, presented opposite inequalities both in time and in height, regularly alternating, varying with the moon's declination, disappearing with it, and re-appearing with it, and following it regularly, without regard to other simultaneous changes of a different period, then it became plain that no other inference could be drawn, than that which he had mentioned; when, further, he had proceeded to treat these tides as compounded of two successive tides, one due to a transit 12*h* 24*m* later than the other, and had used for this purpose two simple river tides super-imposed at a distance in time corresponding to that at which the northern and southern tides could enter the Firth, he had obtained a close representation of the double tides of the Firth of Forth; when these two methods of examination ended in the same conclusion, he conceived that it had obtained a very high degree of probability. By means of these observations tide-tables had been formed, which were designed to afford a more accurate means of predicting the local tides of the east coast of Scotland than any we now possessed.

Dr. Robinson and the President put several questions to Mr. Russell, for the purpose of eliciting the facts more clearly.

Lord Mountcashel inquired whether Mr. Russell had observed and accounted for any of the tidal phenomena which were denominated bores, and described one which he had witnessed in the river Seine, the rapidity of which far outstripped that of the steam-boat in which they were proceeding.

Mr. Russell said that he had frequently observed this phenomenon, and described the bore of the river Dee, and of the Solway frith. He then briefly accounted for it on the principal of the tidal wave coming with enormous rapidity from deep water, where it was freely propagated into shoal water, where the upper part, retaining its velocity less impaired while the bottom was retarded, it toppled over, at length, breaking in its rapid onward course.

Captain Larcom observed that the ordnance survey would contain a very full account of the tidal phenomena along the coast of Ireland. Captain Larcom hoped before long to lay before the Association the result of the observations made on the coast of Ireland in the course of the ordnance survey. Gauges were established at different stations, and observations have been made every five minutes during the course of three lunations. The direct object of them was to obtain data for the plane of mean sea level; but while the observations (which are now in course of reduction) are likely to decide this, they also give much valuable information as to irregularities like that just mentioned. He might mention that in Lough Swilly the spring tide high water was eight feet higher than in Lough Foyle.

Mr. Hawkins read a paper on the *Friction of Water on Water*, as exemplified in the well-known experiment of emptying a vessel full of water by sending a jet of the fluid through it. This friction of the particles of fluid against each other, caused the principal obstruction to the motion of ships through the water; and he conceived that it would be advantageous to grease the bottoms of ships to diminish the friction.

On the Form of Ships.

Mr. Scott Russell read the "*Report of the Committee on the Form of Ships.*"

The report was voluminous; it contained the reductions of a large number of experiments, and about 20,000 observations, made on more than 100 vessels of different forms; accurate drawings of all of which, on a large working scale, were laid on the table. It was the hope of the committee that this report might be published, in order to give the public all the benefit which accurate knowledge on this point was likely to convey. He did not, therefore, enter fully into the details of these voluminous results, but would confine himself to a general account of the objects which this committee had in view, the methods of inquiry which they had adopted, and a few of the more general conclusions to which they had been led. These experiments had now occupied the attention of the committee during a period of five or six years, and it afforded him peculiar pleasure to be able to present the concluded investigation to this meeting. It was appropriate to this meeting, inasmuch as Cork was an important sea-port, of increasing prosperity, whose interests were involved in everything tending to the improvement of our mercantile navy: it was further appropriate, inasmuch as there existed in the vicinity of Cork a class of the fastest sailing vessels in existence—he meant the fleet of yachts—by the successive trials of which many improvements had been made in the form of vessels; and, indeed, he considered it due to the yacht clubs of this country to say, that much had everywhere been due to their exertions in the improvement of the speed of our ships. He had had the good fortune to find in Cork a gentleman who, in the recesses of his own study, had been carrying on, for many years, valuable scientific investigations on this subject, who had submitted his views to experiment with great success, but had long felt the want of just such a series of researches as he had this day the pleasure of laying on the table. The beautiful models by which the report was illustrated, had been constructed by Dr. Phipps, to whom he had thus alluded; and in Mr. Beamish, also a native of this place, he had found another scientific and successful investigator in the same field of inquiry. On this account he should enter more fully into this subject, as one in which Cork was especially interested. It had long been the reproach of science, that so little had been done to enable the practical man to proceed with certainty in his attempts to improve the speed of ships. There are some points in which science has done all that can be desired. The immersion of a ship, her trim, her centre of buoyancy, her stability, can all be determined, with accuracy, beforehand, and the scientific naval constructor can proceed with certainty upon fixed principles. It is otherwise with the speed and resistance of a ship. In nothing does calculation more completely fail them than in the attempt to determine beforehand the speed of a ship constructed on given lines, or to show how a form may be so altered as to render it faster than before. To calculate the resistance opposed by the water to the passage of a ship through it, and to find that form which, at a given velocity, will pass through the water with least resistance, and, of course, with the smallest expenditure of power—such was the problem hitherto the least solved, and always one of the most important, which these experiments were intended to investigate. There were also two phases in which this problem presented itself, the scientific and the practical view of the subject. There were, therefore, two classes of experiments—one designed to advance our knowledge of the laws of hydrodynamics which govern the phenomena of resistance of fluids, and the other, the experiments serving as a basis to the operations of the practical construction of ships—the *Experimenta lucifera* and the *Experimenta fructifera* of Lord Bacon. To the latter class, he would confine the remarks of to-day, as belonging more especially to section G, the former having been discussed in section A. Many experiments had formerly been made on this subject, but we had, at that time, so imperfect a system of hydrodynamics, that the conclusions drawn from them could not be relied on with confidence by the practical man. The Academy of Sciences had made a series of such experiments at a large expense defrayed by the French government. Colonel Beaufoy, in our own country, had made an important series of such experiments, at an expense of £30,000, but these were of comparatively little value, for the same reason, viz., that the forms did not comprehend such forms as were actually required for the purposes of naval construction, and because the state of science was not such as to enable us, from the resistance of one form, to deduce with certainty that of another. For the purpose of giving practical value to the present series, experiments had been made on many different scales of magnitude, some in narrow channels, others in large canals, and finally on the open sea. Some were made on models 3 ft. in length, others of 10 ft., some on vessels 25 ft. long, 75 ft. long, and some on vessels 200 ft. long, and nearly 2000 tons capacity. Thus it was trusted that the scale of the experiments was such as to give confidence in the results. Next, as regards the forms of vessels made the subject of experiment, these were similar to those required for the practical purposes of construction. One class consisted of such forms as were required for steam navigation. Plans of steam ships of the best construction and others of worse forms, were accurately laid down on the same scale, in the same way, and with the same accuracy of proportion as if they had been for actual service, and along with these were some of new forms. A given form having been found to be a good one, was then varied by lengthening, first in one manner then in another, to discover the best mode of improving a given good form. In sailing vessels, some of the celebrated Chapman's best forms were taken, and treated in a similar manner, and along with them were com-

pared the common forms of merchantmen and other ships. The class of fast-sailing yachts and cutters was treated in the same way, the object always being the determination in given circumstances of the method of giving such a form to a ship as shall enable her to pass through the water with the least resistance, the greatest velocity, and of course the smallest expenditure of force, power, and money. The methods of drawing these vessels through the water, varied with the scale on which the experiments were made. Those on the smallest scale were drawn by a weight arranged in such a manner as to supply a uniform force through any given distance—and on the largest scale, the experiments were made on the sea by means of powerful towing vessels. In this way the experiments were made on a wide range of magnitudes, both as regarded the vessels themselves and the sheet of water on which they were propelled, an element of resistance not always sufficiently taken into account. The resistance was accurately measured by dynamometric apparatus of great accuracy, through which the moving force was communicated to the vessel; the velocity being determined, in certain cases, by a peculiar apparatus designed for this purpose, and in other cases by instruments for measuring and marking time with accuracy. After the observations had been reduced by independent calculators, and not till then, were they made the subject of special examination, with reference to any theory; and thus it was conceived that the greatest amount of authenticity had been secured. The author then proceeded to give to the meeting a number of specimens of the results which the experiments afforded, such as he knew were likely to interest those members of the section who were acquainted with the principles of naval construction. He demonstrated a remarkable law, by which it appears, that each velocity has a corresponding form and dimension peculiar to that velocity; and he showed, in a variety of diagrams, the means of constructing such forms. To show how much influence *form* alone, without any other element or dimension, affects the question of resistance, he adduced the following as one of the most important experiments. Four vessels were taken, having all the same length, the same breadth, the same depth, the same area and form of midship section, and all loaded to the same weight, displacement, and draft of water. The only difference being in the character of the water-lines; No. 1 being of the new form indicated by these experiments as that of least resistance; No. 3 the old form, very nearly the reverse of the first; No. 2 intermediate between them, and No. 4 intermediate between No. 1 and No. 2. The following table shows the result of the comparative trial:—

Speed in miles per hour.	Resistar			
	No. 1.	No. 2.	No. 3.	No. 1.
3 miles	10	12	12	11·3
4 ..	18	22	23	21
5 ..	28	38	12	35
6 ..	39	61	72	56
7 ..	52	96	29	84

These differences showed how much might be gained, everything else being equal, by the adoption simply of judicious form in the construction of the water lines of a ship. The vessel No. 1 was constructed on the wave-line; the methods and rules for which he proceeded to explain in diagrams, too numerous for our space to admit. But we hope the speedy publication of the report itself may soon remedy this omission.

Mr. Perry observed that the position of the paddle-wheels in steam vessels was an important subject, which required to be determined, especially as different opinions were entertained by practical men whether the paddles should be nearer to the stern or to the head of the vessel.

The Marquis of Northampton remarked on the importance of these experiments, which had been carried on by the British Association. The results would possibly produce a change in the naval architecture of every country in the world; and if the British Association had done nothing else than carried out these experiments, and attained those important results, all the efforts they had made would have been amply rewarded.

Mr. J. Taylor observed that these experiments had been carried on for five years, and that the late Sir J. Robison, who had been associated with Mr. Russell in their prosecution, had watched over them with great anxiety till within a short period of his death. The Association had expended £850 in making these experiments, and now came the question, what was to be done with the valuable body of information that had been collected? It ought not to lie idle on their shelves, but ought to go forth to the public; and the best manner of accomplishing that would be a subject of consideration for the Council.

Mr. Russell said, that with regard to the position of paddles, the subject had been already taken up by the government, and some practical results might shortly be expected. In conducting the experiments for the British Association, Sir J. Robison and himself ha[ving] satisfied themselves as to the correctness of their system, they had endeavoured to get it introduced without exciting opposition. The experiments were made in a ship-building country, and ship-builders every now and then borrowed the forms of the boats that had been found to move the fastest through the water, and thus they had been gradually introduced. The *Flambeau*, which was built on the Clyde in 1839, on one of the experimental lines, beat a vessel of greater length, though having but 75 H.P. against 120. In smooth shallow water the vessel on the old construction was a match for the *Flambeau*, but in a deep and heavy sea the experimental vessel beat the other by two miles an hour. There had been since constructed in that part of the country a whole class of vessels built of that form. The *Great Britain* had the wave water-line; and the *Vanguard*, which made her passage last week from Dublin to Cork in two hours less time than had ever been previously accomplished, constructed by the same builder who had made the models for the British Association experiments.

Elasticity of Materials.

"*Experiments to prove that all Bodies are in some degree Inelastic, and a Proposed Law for estimating the Deficiency.*" By E. Hodgkinson, F.R.S.

Mr. Hodgkinson said it was a principle generally acknowledged in the present day, and employed by those who have written on the subject of elasticity, that, when bodies are acted upon by forces tending to elongate or compress them in a small degree, the changes produced are in proportion to those forces; and that equal extensions and compressions are produced by equal forces. That this principle is true, so long as the change produced in bodies is very small, is not to be doubted; and as regards *extensions* it is the basis of the early investigations of Jacques Bernouilli on the elastic curve; of Hooke who was its author (Theory of Springs, Phil. Trans., 1666,); Mariotte, Leibnitz (De Resistentia Solidorum, 1684). With respect to elasticity, it was adopted in the profound inquiries of Euler on the strength of columns, which were corroborated by Lagrange (Berlin Memoirs); and with respect both to *extensions* and *compressions*, it forms the basis of the calculations on the strength and elasticity of bodies in the principal theoretical and practical works on mechanics of the present day; as the Mécanique of Poisson, and the works of Whewell, &c.—the practical treatises of Navier, Poncelet, Tredgold, Barlow, Moseley, &c. He hoped, however, to convince the section that this principal does not operate *alone* in the resistance of bodies subjected to tension, or to compression, or to both. He hoped, too, to show the law which the element, not considered by writers, nor generally known to exist, is subject to. This element is a defect of elasticity, or a set, to which all bodies made to undergo a change of form, however small, seem to be liable. The defect here mentioned was known to exist only when the body had been strained with a considerable force, or such as to be equal to one third, or upwards, of the breaking weight. But the experiments which he should adduce would show that the defect commences with the smallest changes of form, and is increased according to the square of the extension, or compression, or of the weight. Thus, if e represent the extension or compression which the strained body had undergone, and $a\,e$ the force which would have produced that extension or compression if the body had been perfectly elastic, the real force necessary to produce this change, e, will be less than the former by a quantity, $b\,e^2$, representing the defect of elasticity. Hence the force required to produce a change, e, is $a\,e - b\,e^2$, where a and b are constant quantities. He had found this law to obtain when the change produced in the body arose from extension or compression alone, but when the change arose both from extension and compression, as in the flexure of a rectangular body, the force of a fibre was to that due to perfect elasticity, as $a\,x - b\,x^2$ to $a\,x$; or it was equal to $a\,x - b\,x^2$ where x was the height applied, and a b constant quantities, as before. In proof of these statements, Mr. Hodgkinson mentioned that having remarked, in his experiments made for the British Association on the subject of hot and cold blast iron, that the elasticity of bars broken transversely was injured much earlier than was generally assumed, he paid particular attention to this circumstance in his future experiments, and had bars so formed that he could separate the elasticity of extension from that of compression; by these bars, which were very long and of small depth, he perceived that one-fiftieth or one-eightieth of the breaking weight was sufficient to injure the elasticity. He mentioned the matter to his friend Mr. Fairbairn (who was associated with him in the inquiry), soon after he had made the discovery; and Mr. Fairbairn's subsequent experiments made to determine the strength of rectangular bars of iron, from all parts of the kingdom, were conducted in the same manner as Mr. Hodgkinson's had been; the deflexion and quantity of set, or defect of elasticity, from each weight being always observed. Mr. Fairbairn's experiments were on bars cast one inch square and five feet long, and were made with the utmost care; Mr. Hodgkinson has, therefore, adopted their results with respect to the "set," and taking means both from Mr. Fairbairn's results and his own on the same sort of bars, he has sought for the relation between the weights and the mean sets from those weights, these sets being the deflexions or deviations from the original form of the bar, after the weights have been removed. To ascertain the relation above, Mr. Hodgkinson has curves described from the results of the experiments, making the sets the abscissæ, and the weights the ordinates; and the similarity in appearance of these curves to the common parabola, led him carefully to examine whether they were not in reality represented by that curve. The examination was successful—the parabola was the curve; and the mean results

of the observed sets, together with the calculated ones, from equal additions of weight, from 56 to 448 lb., derived from 44 kinds of cast iron, and from 90 to 100 experiments, were as follows:—

Weights ..	56	112	168	224	280	336	392	448
Mean sets ..	·003	·013	·026	·047	·069	·102	·136	·197
Computed sets parabolic	·003	·012	·027	·047	·072	·102	·138	·181

Mr. Hodgkinson made experiments on stone, timber and wrought iron, and observed the quantity of set in all. These different materials, when the results from them were constructed, all gave the form of the parabola, though less perfectly than in cast iron, as the experiments on them were but few. It appears, from the above-stated experiments, and others that were made, that the sets produced in bodies, are as the squares of the weights applied. Hence, there is no weight, however small, that will not produce a set and permanent change in a body; all bodies, when bent, have the arrangement of their particles altered to the centre; and when bodies, as the axles of railway carriages, are alternately bent, first one way and then the opposite, at every revolution, we may expect that a total change in the arrangement of their particles will ensue. It appears, too, from the results of these experiments, that all calculations hitherto made, on the strength and elasticity of bodies, have been only approximations. Mr. Hodgkinson stated, that he laid the results of this communication before a meeting of the Literary and Philosophical Society of Manchester a short time ago, soon after he had made the discovery which it contains. In the prosecution of the experiments he had received every assistance which the works of his friend, Mr. Fairbairn, could supply; and Mr. Robert Rawson had kindly assisted him in the reduction and arrangement of the results of the experiments.

This communication gave rise to much conversation, in which the President, Prof. Lloyd, Dr. Robinson, and other persons joined, and in which all agreed, that these experimental inquiries were of the utmost importance in supplying a solid foundation for the speculations of the mathematical investigator in this most difficult branch of physical inquiry. Dr. Robinson also inquired, if Mr. Hodgkinson had observed whether the molecular structure of the bodies, on which he had experimented, was altered in any manner, and if so, how did the change take place, during the progress of the experiments? Mr. Hodgkinson replied, that he had no means of determining this point satisfactorily, but he had no doubt, that matter, when subjected to strain, long before it broke, had its molecular structure permanently deranged. He exemplified this by the axles of locomotive engines, which, as they turned round, had the parts that were extended and compressed successively underneath and above; and after this action had been continued for a long period, they were found to become of a kind of crystalline structure, internally, and of course were much impaired in strength.—Prof. Stevelly said, that the forces to which they were subjected were in kind, though not in degree, something like the alternate bending back and forward of a piece of wire under which it at length broke.—Mr. Hodgkinson assented.

"*On Changes in the Internal Construction of Metals.*"

Mr. Lucas, in the absence of Mr. Fairbairn, reported the progress of the Committee appointed at the last meeting, to ascertain experimentally whether any and what changes take place in the internal constitution of metals exposed to continual vibration and concussion. (The results of these experiments were stated by Mr. Hodgkinson in the last paper).—The effect of concussion on the shafts of tilt hammers is very remarkable. The shafts are made of the best ash, but after three or four months' use the strength of the wood is so much deteriorated that the shafts break off short as if they were rotten. Copper is also similarly affected by concussion, and in working copper articles, and in rolling silvered plates of copper, the workmen find it necessary to anneal the metal to prevent it from breaking.—Mr. J. Taylor observed that this subject had been much discussed at Manchester, and with the same results. He alluded to the difficulty of procuring good chains, and said it occurred to him that probably it might arise from the chain maker being *too good* a workman, and that the evil was caused by too much swaging in finishing the work. If, however, the quality of the iron could be restored by annealing, as might be inferred from these experiments, that would present the means of obtaining good chains in the first instance and of strengthening them after use.

ON CONTOURED MAPS, BY CAPTAIN LARCOM.

It is important that maps constructed by the government should exhibit the levels of the country in the most intelligible manner; showing heights not merely on the tops of hills, but round their sides, and through the valleys which traverse them. Such a system is offered by these contours. They are a series of horizontal lines, at a certain distance asunder, and at a certain height above a fixed datum. The datum most commonly used is the level of the sea, doubtless from the shore line being the limit of the land, and the point at which roads must cease, as well as from an impression that it is itself a level line; and therefore, as the first contour, the most appropriate and natural zero, from which to reckon the others. The Section were aware that it has been a point much discussed, whether the high water, the low water, or the mean state of the tide, offers the most level line. This is a point which it would be out of place to discuss here, but it may be stated that, in order to determine it, as far as Ireland is concerned, a series of lines has been very accurately levelled across the island in various directions, and permanent marks are left in all the towns, and on numerous public buildings; and at the end of each of these lines on the coast, tidal observations have been made every five minutes during two complete lunations. These observations, and the connecting lines of level, are now in process of reduction—the degree of accuracy attained is such that a discrepancy of ·2 of an inch is immediately apparent—and from them we may expect many points of interest. The steeper the natural slope of the ground is, the closer together the contours, of course, will be, and the more oblique the road; where, on the contrary, the ground slopes very gently, the contours are further asunder, and the road may be proportionally more direct. By examining the maps of the Irish Survey, on which contours have been drawn, it will be seen that they tell sad tales of the existing roads, every one of which ascends and descends frequently, instead of keeping on a gradual slope for its whole length. In order to exhibit these lines, it is proposed, instead of adding them to the original copperplate, which has a peculiar value as an official record of boundaries, to make a copy of the plate by the electrotype, for the purpose of receiving these lines. Contour maps were thought of early in the progress of the survey, but means were wanting for their execution; at present, however, the outline survey being complete, and the general map, or map of the surface, being in progress, affords a convenient opportunity, which it is hoped will not be lost.

Dr. Robinson inquired of Capt. Larcom whether the process of contouring the maps was proceeding, and how soon he supposed it would be completed for Ireland.—Capt. Larcom replied, that for the present it had been suspended.—Dr. Robinson observed, that whether he considered the value of this process in relation to the general interests of science, or the most important practical economies of the country at large, he could not but deeply deplore the suspension, temporary though he hoped it would be, of this great national undertaking; and he trusted that, before the British Association closed its present sitting, the most energetic steps would be taken to make such an application to government as would induce them to resume this most valuable work. He begged to inquire from Capt. Larcom, what the expense would probably be.—Capt. Larcom replied, that he should estimate it certainly at less than a farthing an acre.—Dr. Robinson: And the original cost was probably sixpence or eightpence.—Capt. Larcom said, perhaps sevenpence to ninepence.—Dr. Robinson: Then, at a cost of about one thirty-second part of the original expense, this invaluable addition to that splendid work, the Trigonometrical Survey of Ireland, could be accomplished. If it was determined finally to suspend this work, he should say that it was very like what the homely adage characterized as penny wise and pound foolish.

"*On a Method of ascertaining Inaccessible Distances at Sea or Land.*"

Mr. P. Leahy read a paper on a method of ascertaining inaccessible distances at sea or land, for which he claimed the advantages of greater accuracy and expedition than by the method of measuring a base line by the log. On his plan two small telescopes are fixed at the greatest distance the vessel will admit of, and so as to form some multiple of ten feet. This distance forms the base line on which the calculations are to be made.—Mr. Macneill being requested by Dr. Scoresby to state his opinion of the invention, the latter said that it was sound in principle, but he thought with so short a base line and with the difficulty of taking simultaneous observations at sea, it would be liable to inaccuracy.

"*Formation of Concrete.*"

Mr. Hawkins made a communication on the formation of Concrete, showing more particularly the importance of having the stones of the proper sizes, so that the smaller ones should as nearly as possible fill up the interstices of the larger. Where the sizes were properly adjusted, he found that one proportion of lime to twenty of shingle, formed a stronger concrete than when larger proportions of lime were used. Some engineers are in the habit of using one of lime to six of shingle, and the proportions generally used are as one to eight. A specimen of concrete made in the proportions he recommended, and with shingles of proper sizes was found after a short time to be stronger than an old Roman wall.—Mr. Macneill said he preferred artificial cement to lime, and he had found great advantage to result from allowing the mass of concrete to fall from a height, by which means the shingle became more compressed together. Mine dust mixed with lime, he believed, made the most perfect concrete.—Mr. Jessop and Mr. Taylor also approved of mine dust. The latter observed, that it was probably from the quantity of iron in mine dust, that its adhesive properties were derived.

"*Raising Sunken Vessels.*"

Sir T. Deane explained the method adopted by his brother, Mr. A. Deane, to raise the *Innisfaile* steam vessel, of 500 tons, which was sunk by striking against an anchor in the Cork river a few years ago. The ordinary methods of raising sunken ships having proved ineffectual, a coffer-dam was made round the vessel in the middle of the river; and pumped dry by means of eight or nine chain pumps. The leak was ascertained by digging under the ship, and a cow hide was nailed over it to keep it water-tight. The coffer-dam was removed as quickly as possible, when the *Innisfaile* again floated by her own buoyancy, and the steam having been got up, she was taken to Passage to undergo the necessary repairs. The whole cost was 400*l*., and the work was done in the course of four tides.

KYANIZING TIMBER.

ANTI-DRY-ROT COMPANY, (KYAN'S PATENT).

(*An Advertisement.**)

MR. EDITOR—Mr. W. B. Prichard has recently published a letter in several periodicals, in which he expresses astonishment that I should state that both his report and letters are inaccurate, and, because I used so mild a phrase, he has thought proper to make further statements of a like character; I therefore feel it my duty to state and prove, that in some instances he has omitted to state the *whole* truth, and in others he has challenged what is decidedly *untrue*.

He omitted to state that the sleepers that had shown symptoms of decay were prepared, *by way of experiment*, with solution only half the strength required by the patent.

He *stated* that, at Shoreham Harbour, a waling piece, the very heart of English oak, Kyanized, in use only four years, was like honeycomb, completely eaten away by the teredo navalis.

A full board of the commissioners of the harbour, appointed a committee to view, who have reported the Kyanized timber *as sound as when first put in.*

He stated that he had removed the oak waling, and that the decay was below water mark. I annex the certificate of five witnesses, three of them gentlemen of unexceptionable character, and the other two are his own witnesses, who assert that he could not have taken an *oak* waling from below water mark, as those walings are exclusively of *beech*, and that no Kyanized waling has been removed within the last six years; they also report, that after a careful survey they can find no symptoms of decay in any of the piles.

Mr. Prichard has inserted a certificate from Mr. Buckwell and Mr. Butler, in confirmation of his assertion, that the piles are decayed, which I have ascertained was written *before* the inspection took place, and objected to afterwards, and nevertheless published in its original form; how much dependence can be placed on this certificate may be ascertained from the annexed letter, (No. 3.) from the gentlemen who signed it.

Mr. Prichard also inserts a certificate from the workmen at Shoreham Harbour, that they inspected the piles *in the presence* of Mr. Meredith, engineer to the Brighton Railway.

The workmen positively deny that Mr. Meredith did accompany them during the survey.

Mr. Prichard asserts that Lord Manvers has impugned Kyan's process. I am authorised by his lordship to state that "after very extensive experience of its effects, his early impressions in favour of the discovery has been abundantly confirmed," and that he continues to have "unshaken confidence in its efficacy as a preservative of timber of every description."

Mr. Prichard insinuates, that Mr. Brunel, under whose directions immense quantities of timber were Kyanized for the Great Western Railway, is now opposed to our process.

I annex a letter (No. 4) from the engineer's office of the Great Western Railway, from one whose name will well vouch for the truth of the statement, "that after Kyanizing upwards of 40,000 loads of timber he is well satisfied with the result, as after six years' trial, the timber, on every examination, has proved as sound as when first laid down."

Mr. Prichard asks how many hundreds of the sleepers on the Brighton Railway have decayed.

I submitted his question to the chief engineer on that line, and he stated in reply, that he is not aware that one *Kyanized* sleeper is decayed.

Mr. Prichard states, that the opinion he has given about Kyanizing is perfectly disinterested, although he strongly recommends the process belonging to his friend and solicitor.

These statements of Mr. Prichard are so void of truth, that I feel it my duty to expose them, and having done so, am convinced that any further statement Mr. Prichard may make will prove innoxious, and not require any reply from me on behalf of the Company.

2, Lime Street Square. TASWELL THOMPSON, SEC.
6th Sept., 1843.

LETTERS AND CERTIFICATES ABOVE REFERRED TO.

No. 1.

WE, the undersigned, having at the request of Mr. Taswell Thompson, this day minutely inspected several of the piles of in the east pier of Shoreham Harbour, embracing all those represented to have been Kyanized, and many which have not been subjected to that process, do certify that we find no symptom of decay whatever in any.

We have carefully surveyed the whole of the two lower waling pieces, and find no indication of any of the original having been removed. The material employed for this purpose is beech exclusively.

We further report, that the piles both descriptions, on the east side of the said pier are slightly touched by the worm, just above the sand.

J. B. BALLEY, Ship Builder.
WILLIAM TATE, Timber Merchant.
Shoreham, THOMAS THORNTON, late Harbour Master.
August 22th, 1843.

No. 2.

WE, the undersigned, have worked as carpenters at Shoreham Harbour for the last six years, and well know all the Kyanized wood, and can state positively that not one of the Kyanized walings have been removed since they were first fixed in the pier; and we can also state positively, that the two lower walings are formed alone of beech.

Witness, WM. JINGLE. ROBERT BURT.
Shoreham, WILLIAM RATCLIFF.
August 29th, 1843.

No. 3.

SIR—In reference to the report of our view of the piles of Shoreham Harbour, on the 3rd June last, published by Mr. Prichard, we beg to state that its contents, both surprised and annoyed us, as we did not intend to say that any of the piles referred to are decayed, but requested Mr. Prichard to erase the words "gone through several stages of decay," and state instead, that the unprepared and prepared were in a like state of preservation; and we beg to add, that in giving our opinion, we were led to believe, that the Commissioners of the Harbour had requested us to report upon the condition of two chips of wood submitted to us, and not for the purpose of publishing our report as to the efficacy or non-efficacy of Kyan's Patent: and that we had no means of judging which was the prepared wood and which the unprepared, but deemed Mr. Prichard's word sufficient authority, as he was at that time an officer under the commissioners.

Shoreham, CHAS. DOWLEN BUCKWELL.
August 29th, 1843. GEORGE BUTLER.

MR. TASWELL THOMPSON,
Lime Street Square, London.

No. 4.

Great Western Railway, Engineer's Office.
27, Portland Square, Bristol.

DEAR SIR—I have sent you by the carrier a section from the centre of one of our longitudinal timbers of the permanent way; it was Kyanized and laid on the line about six years ago, and you will perceive it is as sound as the day on which it was first put down; it is not singular, with us but in all my examinations I have found it equally sound. I think this simple fact will be highly interesting to you, and you will not begrudge the expense of the carriage.

I would remark that the pickling having been entirely under my management, I was very particular in having the strength of the solution maintained. Upon first immersion the strength was 1 in 14, at a temperature of 62°, and the time of immersion for seven-inch timber was eight days, during this time the solution was kept at a uniform strength by pumping. In this way I have pickled upwards of 40,000 loads of timber, and the quantity of sublimate consumed comes out at about 1¼lb. to the load.

T. THOMPSON, Esq. Your's truly,
August 31st, 1843. J. HAMMOND.

THE PYRAMIDS OF GIZEH.

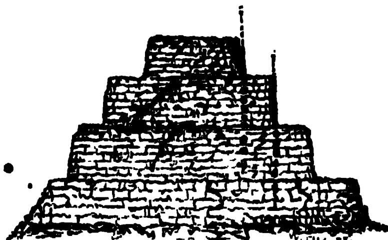
THE last monthly meeting of the Egyptian Society was very fully attended, as it was announced that Dr. Lepsius would give some description of the researches made by the Prussian Expedition.

Mr. E. W. Lane being unanimously called to the chair, Dr. Lepsius commenced by stating that he felt it to be his duty, whenever he had the opportunity of visiting Cairo, to communicate any information that he might consider interesting to so useful and liberal a Society. He felt assured, from the great progress already made in the few years since its establishment, that it was destined to fill an important place in the history of scientific research in this country. The Doctor then alluded, in proof, to the valuable memoir lately published by the Society, contributed by M. Linant "Sur le Lac Mœris." He offered some observations on the mode of constructing the pyramids, and enumerated the many theories that had been advanced concerning the objects and the construction of these vast monuments. He, however, considered the fact established, that their object was simply to mark the places of tombs, and he then proceeded to explain to the meeting the manner in which they were constructed.

The great pyramids of Gizeh are (in comparison with many others) in a good state of preservation. From the largest, little besides the

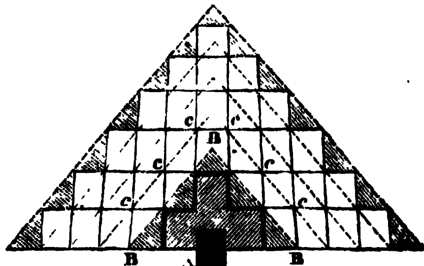
* We cannot allow this controversy to be continued unless the communications be paid for as Advertisements.—EDITOR.

casing stones have been removed. In the second pyramid a part of the casing yet remains. In these it is impossible to see the interior construction of the stone work. But some of the small ruined pyramids at Gizeh consist of several steps, each of several courses of stonework in height, instead of the usual form of four sides regularly converging to an apex; and in the more ruined parts of these pyramids it is seen that the steps are formed by walls built against each other, as shown by the dotted lines in the following sketch.



The masonry of the pyramids of Abousir and Saccara is very inferior to that of the pyramids of Gizeh—in all of these the step construction is clearly seen, and also that the steps are separate walls built against each other. The pyramid at Merdoon, again, exhibits this mode of construction. In its present form it rather resembles a huge square tower, the walls of which are slightly inclined, than a pyramid: the outer layers having been mostly removed, the core or central part is left standing alone. In short, in the examination of a great number of pyramids, from Gizeh to the Fayoom, the same mode of construction was found.

To explain a mode of building apparently so contrary to sound masonry, we must suppose a chamber A for the tomb, in or under the



small pyramid B B B, built over it: by filling up the angles of the steps, and adding the fine smooth casing stone, this small pyramid would be completed; but if it were desired to enlarge the work, instead of filling up the angles to prepare for the casing, another step, of the same height and depth as the first, being added to each step of the first-mentioned pyramid, the outline touching the exterior angles of these steps, *c c c*, &c., would be parallel to the outline of the first pyramid; and so on, by continually adding steps of the same section, the pyramid would be increased to any size. The foregoing sketch thus shows five pyramids, one within the other. Dr. Lepsius stated that he was indebted to Mr. J. Wild, architect, for this suggestion, and it agrees with and explains the account given by Herodotus, who states that machines were placed upon the steps, and the stones raised from one step to another. The Doctor then explained, in confirmation of his views, the remarkable pyramid of Dashour; he considered the obtuse angle of the upper part, as the original angle intended. Moreover, Dr. Lepsius observed that this mode of proceeding is in harmony with that adopted by the Egyptians in their tombs excavated in the rock. It is found at Thebes that the first care of the reigning king was to excavate in the rock, and complete and decorate, a chamber for his tomb. If his life continued after the end of this labour, another chamber was added, and then another, and so on; and it is found that the largest tombs are those built by the kings who have reigned the longest. In the same manner, the pyramids may have been continually enlarged during the lifetime of the kings for whom they were intended. All the evidence that remains shows that the largest pyramids were of kings who reigned a long time. It must be remembered, that among the Egyptians it was the duty of the individual to provide a tomb for himself; his successor was immediately occupied upon his own, and thus we find many tombs either hastily or imperfectly finished, and chambers left in all states of progress. Could a monument of such stupendous size as the great pyramid of Gizeh, have been contemplated as an original plan, to have been finished, or nearly so, in the lifetime of one man? but it is easy to conceive that by perpetual additions during a long reign, such a building may have been completed.

Dr. Lepsius then exhibited a selection of beautifully finished drawings of the subjects and inscriptions decorating the tombs found the pyramids of Gizeh and Saccara, architectural plans, sections, &c. The time allowed was too short for more than a slight examination of them. The explanations given of some of the subjects was very interesting.

The Doctor did not refer to his researches in the Fayoom. I am, however, enabled to inform you, that he has fixed satisfactorily the place of the labyrinth near the pyramid of Howarra, and has traced, from what remains, a general plan of it. Its complete ruin is owing to the walls having been built with rude brick, and merely faced with stone; from the same cause, the tombs at Saccara are nearly all destroyed, while those at Gizeh, which are entirely built of stone, are in good preservation.

By the liberal regulations of the Society at whose rooms this lecture was delivered, strangers are permitted to use the library and attend the lectures, if introduced by a member. I had thus the opportunity of hearing the paper I have endeavoured to report to you. The library, although not very large, contains nearly all the valuable works on the antiquities of Egypt and the surrounding countries, the works of the best travellers and historians, some upon Arabic literature, &c.

Dr. Lepsius left Cairo to-day for Upper Egypt.—*Athenæum.*

Cairo, August 17.

ST. GEORGE'S CHAPEL, WINDSOR.

The extensive alterations and embellishments which have been in progress since the early part of May last (from which period the chapel has been closed), at an outlay of several thousands of pounds, throughout the interior of this sacred edifice, having just been brought to a close, the following description of the ornamental and newly emblazoned portions of the chapel of St. George, the curious discoveries made during the progress of the works, and of other objects of interest connected with the late repairs, will, no doubt, be interesting to a numerous portion of our readers.

It is now nearly a century since this chapel had undergone any repairs. At a chapter held by the dean and canons in February last, it was resolved that the chapel should undergo throughout a thorough cleansing and renovation; that new stained glass windows should be introduced in various parts; the organ repaired, ornamented, and many additions made to it; the whole of the elaborate wood carvings and the alabaster and marble monuments in the several private chapels and aisles, restored to their original state; and other embellishments added, so as to render this ancient building one of the most magnificent sacred edifices in the kingdom.

The beautifully groined ceilings of the nave and choir has been thoroughly cleaned by means of immense scaffolding reaching from the floor to the roof; and the whole of the defective parts carefully pointed and restored by experienced workmen. The groined ceilings, also, of the side-aisles, chapels, and transepts, have undergone the same careful and extensive renovation, and likewise the organ-loft and that portion of the chapel at the back of the altar. The whole of the whitewash and colouring matter upon the stone pillars, window-jambs, arches, and piers, and upon the hitherto half-hidden Gothic screens to the Hastings, Beaufort, Lincoln, and other chapels, have been removed, restoring the stonework to its rich and varied natural tints, and producing a most beautiful effect. The numerous monuments, and the interiors of the private chapels, belonging to noble and distinguished families, have also been carefully restored.

The whole of the splendid Gothic oaken stalls of the Knights of the Garter (on either side of the choir and those facing the altar) have been cleaned, and repaired where necessary, so as to render them strictly perfect, at an enormous expense. The richly and most elaborately carved canopies over the stalls of the knights (above which are suspended their banners, with their mantles, swords, helmets, and crests, were taken down to undergo a similar renovation and repair. They have also been re-stained and varnished.

The dark and dingy-looking paint which covered the exquisite wood carving of the stalls, has been carefully scraped off, and the wood left in its own tint, which has considerably improved and heightened the general effect of this portion of the interior of the chapel.

It may here be mentioned that on the pedestals of the stalls the life of our Saviour is represented in richly carved work, and on those under the organ-gallery are the adventures of St. George. In 1814

an addition was made to the number of knights, and six new stalls were in consequence added, in front of which are carved representations of the attempt of Margaret Nicholson to assassinate George III.; the procession of the King to St. Paul's on the day of thanksgiving for his recovery, in 1789, the interior of the cathedral on that occasion, and of Queen Charlotte's charity school. On the outside of the upper seat of the stalls, a broad girth, continued round both sides of the chapel, is carved, in Saxon characters, with the 20th psalm, supposed to be intended as a supplication for the sovereign of the Order of the Garter.

The projecting front of the Royal closet (over the north side of the altar, and above the tomb of Edward IV.), which had always been considered to be composed of carved stone, was discovered, upon cleaning off various thick coats of paint and white wash, to be of carved oak, of a very early date and in a most excellent state of preservation. Such is the rare character of the style of its carving, that there is but one other specimen of its kind in the kingdom, and that is to be found in the Cathedral at Lincoln. The wainscot carved front of Her Majesty's closet has been stained and varnished, and it has now a most pleasing effect as it strikes the spectator upon entering the choir from the west.

The three principal lines of the heraldic bosses on the vaultings of the nave and transepts have been emblazoned with the arms of former Knights of the Garter, and of the most ancient and distinguished families in the empire, and the entire of the bosses, pendants, and knots of the vaulting in the choir have been similarly emblazoned, and in the same rich and gorgeous style, under the immediate superintendence of Willement, of London, to whom the whole of this portion of the embellishments of the chapel, the restoration of the great west window, and the introduction of new windows of stained glass, had been confided by the dean and canons.

A magnificent and highly wrought brass lectern (upwards of six feet high), which had lain in a dilapidated and neglected state, amongst some rubbish, in a vault of the chapel for upwards of a century, and which had been fortunately discovered by the Dean, has undergone a perfect restoration, and now occupies its proper place in nearly the centre of the choir, at the west end of the stone over the vault of Jane Seymour, the Queen of Henry VIII. The top, which is in the form of a double desk, constructed to hold the sacred volume on one side and the Book of Common Prayer on the other, turns round upon a pivot, and from this lectern the lessons will, in future, be read by the minor canon at divine service in the morning and afternoon.

Ten windows (five on either side), of stained glass, containing in compartments the heraldic bearings of all the Knights of the Garter from the institution of the order, have been completed by Mr. Willement on the north and south sides, and at the eastern end of the choir, some portions being over the banners of the Garter Knights. Four other windows (two on either side at the western end) only remain to be similarly emblazoned with the arms of future Knights of the order.

A most pleasing and picturesque effect is produced throughout the choir by the introduction of these stained glass windows, which give a rich, yet soft and subdued tone, to the whole of the interior, in perfect harmony with the religious character of the sacred edifice.

The stained glass of the great west window, which may now be classed amongst the most splendid and magnificent in the kingdom, has been carefully and skilfully restored by Mr. Willement, and an entirely new and improved arrangement of the ancient and scriptural figures and devices has been effected under his superintendence. Within the four chief compartments, at the upper part of the spacious arch, are the badges, initials, and crowns of the following sovereigns Edward III., Edward IV., Henry VIII., and Queen Elizabeth. In the centre of the window are the arms of the patron saint of England, with the initials "S. G." (*Sanctus Georgius*), and at the apex the initials "I. H. S." The whole of the numerous figures contained in the other compartments represent saints, prophets, and apostles; but from the absence, with but very few exceptions, of either emblems or inscriptions, it is difficult to distinguish others than St. Luke, the physician, St. Catherine, St. Dunstan, St. Edmund, St. Edward the Confessor, and St. George.

The general appearance of the sacred edifice, viewed from any one point, is now gorgeous and magnificent in the extreme. The removal of the present wretched specimens of coloured glass in the east window over the altar, and the restoration of its fine tracery and old stained glass, somewhat similar to that at the west end, are nearly all that is now required to render perfect the labour which has been so liberally commenced, and, thus far, so admirably brought to a close.

THE FACADE OF THE BRITISH MUSEUM.

Sir—You may probably be of opinion, that having already called attention more than once to the subject of the British Museum, it is unnecessary to return to it so soon again, more especially as it has since—and, perhaps, *in consequence*—been taken up by other journals. But this last circumstance ought of itself to encourage you not to desist from the good work you have begun, since it must convince you that there exists in other quarters a disposition to support the same views, and, if at all possible, yet secure for us such a façade to our National Museum, as shall eclipse every thing hitherto attempted in the same style, in this country, and triumphantly vindicate the character of Grecian architecture.

A good deal has been said as to the beneficial and widely extended influence which the example of the "Palace of Westminster" will have upon architecture and art generally among us; let it then now be shown. let us have a decisive proof of such in our next greatest national edifice—one where all refinement of art will naturally be looked for, and where even lavish embellishment will be no more than properly characteristic of the purposes to which the building itself is devoted. The one at Westminster is hailed as a very great stride forward in architecture, and as leading to a very much better system of management than has been hitherto observed in regard to our public edifices; are we then now, to step back all at once to our old courses, and to relapse into the apathy we have but just shaken off? Shall we lay the blame, in this instance, on the Trustees of the Museum for their supineness, and their indifference as to what its façade may prove as a piece of architecture, provided there is *house-room* enough within its walls for the various valuable collections deposited in it? Do we yet know if the design has been examined or approved of by them or any one else—Sir Robert Peel, of course, excepted—or has been more than merely assented to as matter of form, without a thought being given to the design itself?

All that can be said at present is, that they appear to have placed themselves entirely in the hands of their architect, to do exactly as he may think fit, or as his ability will permit him. Yet, however they may confide in him, he does not appear to have any great confidence in himself, else wherefore does he maintain such suspicious reserve? It is true, he has not been called upon formally to produce his design, before the public, neither has he formally refused to do so, yet he must be aware—now at least, if not before—that there exists an earnest desire to be made acquainted with it in some way or other—as might very easily be done by a model in relief of the façade, upon rather a large scale, which might be placed for public inspection in the Museum itself—either in the entrance hall, or in one of the galleries.

The very circumstance of the design having, up to the present time, been kept a profound secret, is a strong reason wherefore we should now be plainly informed what it really is; and on an occasion of such high importance, it would be a piece of very false and misplaced delicacy, to refrain from demanding of Sir Robert Smirke to let us see his design beforehand, and judge for ourselves if it be really worthy of being carried into execution, because if not, or is incapable of being rendered so, it had better be laid aside altogether, *coûte qui coûte*, and some more satisfactory one be now prepared in lieu of it, either by himself or some one else.

The façade of the Museum might even now be made the subject of competition there may, indeed, be no precedent in this country for such course of proceeding, and it might accordingly be considered a strange innovation, but it would at all events be a judicious and safe one. Let a liberal premium—say five hundred guineas—be offered for the best design, on the understanding that that will be the sole emolument derived from it, the carrying it into execution being left to the present architect, unless he should prefer to withdraw himself altogether from the business. Thus, *he* would not suffer pecuniarily, and perhaps less in reputation than he is now likely to do, if allowed to proceed as hitherto, and produce what, when completed, will be found to be a signal failure, and will occasion quite as much public dissatisfaction as Buckingham Palace and the National Gallery. Far more prudent would it be in him to acquiesce, however reluctantly, in what might be construed as a tacit acknowledgment of his incompetency, than to leave a lasting monument of such incompetency behind him.

How do we know, it may be asked, that such will prove the case, when no one as yet knows any thing of the design itself? Justly or unjustly very unfavourable suspicions are entertained, and since no attempt is made to dispel them, by producing the design and convincing us how idle are our fears and apprehensions, it is but natural to conclude that such argument is felt to be a very dangerous one to

resort to, and by no means calculated to secure our admiration for the intended façade.

Surely the Institute might, on such a highly important occasion, exert themselves a little, and stepping a little out of their ordinary course, might venture, in their character as a public body, to *recommend* that satisfactory information should be communicated relative to the completion of the British Museum, and all pains be taken to secure its being completed in such manner as to stamp it a national edifice worthy of the nation and of the name it bears—which it is not likely to prove by many degrees, if we can obtain no more valid security for its excellence than the former productions of the architect to whom it is now blindly confided. No satisfactory pledge for requisite grandeur and beauty in the façade, is afforded by the architecture of the inner court or quadrangle; on the contrary, if the former is not to be of very superior quality and design, it may as well be at once a mere plain and substantial piece of "homespun" building, making no pretensions to any sort of beauty. The subject is one which affords ample scope for the display of imagination and refined taste; and to what purpose, I would ask, are subjects of that poetical class—one so very unlikely there should be any after occasion for, proposed to architectural students at the Academy, if, whenever an actual occasion does occur, nothing better than arrant common-place, and dull humdrum, without even a particle of poetry in it, can be provided. Leaving you and your readers to crack me this question,

I remain,

Yours, and all that,

Bl.t rus Britannicus.

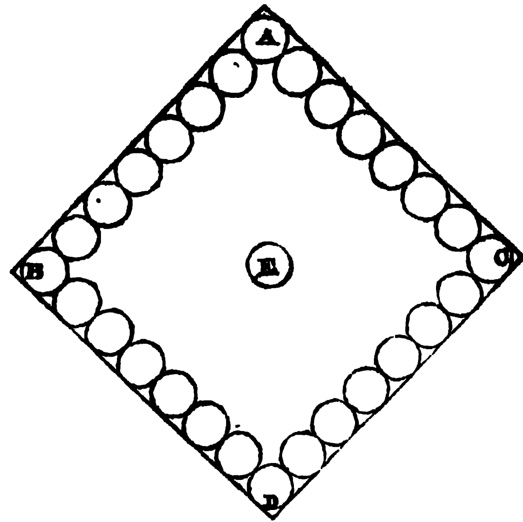
[For inserting the above, in addition to what has already been said in our *Journal* on the same subject, apology is unnecessary. It is one of exceedingly great importance, if not to architects in particular, to architecture and to our national credit in it. Either very much greater importance is attached to the Houses of Parliament and their embellishment than is consistent with public economy, or equal liberality ought to be shown in the case of the British Museum—that is, in regard to what now remains to be done to it. Whether it be now rendered a worthy monument of art, or not, a monument it will be, for ages to come, unless it should happen to be destroyed by fire—a calamity no more to be apprehended for it than for the new edifice at Westminster. The obstinate silence maintained in regard to the design for the façade, is, however, of most evil omen in itself, and bespeaks a determination neither to show, nor to make any appearance of showing, the slightest deference to public opinion, unless upon the extreme compulsion of a general public outcry to that effect. We ourselves have done, and shall continue to do, all we can to force the matter on the attention of our readers, but it is one that ought to be taken up earnestly by the whole of the public press—at least by that portion of it which affects to attend at all to the interests of art. Yet such is not the case at present; for although we do not stand exactly alone, in our anxiety as to the British Museum, there seems to be a strange reluctance on the part of the daily press to bring forward, or even touch upon, the subject in any way. We say "reluctance," because a correspondent informs us that he addressed a letter to the *Times* newspaper, relative to the intended façade of the Museum, but it was neither inserted, nor made use of as a hint for any remarks on the part of that paper.—Ed.]

"THE LIGHT FOR ALL NATIONS" LIGHTHOUSE.

Sir,—He who builds a lighthouse on the Goodwin sands, builds an imperishable name and a monument to his fame, not only as a skilful and successful architect, but also as the enviable deliverer of thousands, and most probably of tens of thousands, of his fellow creatures from the jaws of destruction. The Goodwin bank, about 10 or 11 miles long from north to south, and between 3 or 4 broad, consists of finely comminuted particles of sand firmly compacted together, offering a great resistance to the introduction of smaller bodies, but quickly entombing ships of burthen which are so unfortunate as to be driven upon them, being, as William Lambert remarks in his "Perambulations of Kent, written in the year 1570, "a most dreadful gulfe and shippe swallouer."

Many years ago the Corporation of the Trinity House formed the design of erecting a lighthouse upon these sands, but the idea was abandoned when, after boring to a very great depth, no solid foundation could be obtained; and since then no determined attempt has been made to build a solid structure until the recent one of Mr. William Bush, whose plan was certainly an excellent one as adapted to sands of known superficial depth; but wholly irreconcileable with the constitution of this particular embankment. Not having these experimental borings of the Trinity House before his eyes, and forgetting the golden maxim "Never to begin a thing until the end is well considered," he launched his caisson in an unknown void, to rest eventually on he knew not what: for although he speaks of a rock bottom, this, at best, is but problematical, and our geological ideas lead us rather to infer that the under soil is analogous to the low coast around Pegwell Bay being intersected with chalk cliffs: be this as it may, it was absolutely necessary to the success of this particular plan, that the exact depth of the quicksand should have been previously ascertained.

For carrying out the plan I am now about to propose, this preliminary step is not necessary, other than in choosing the site upon which to commence operations; and here I am far from thinking that the most elevated portion of the bank is the best for the purpose, from the simple reason that being the apex of the submarine hill, the sands are here most probably the deepest, but I would rather choose that portion of the bank which presents the most precipitous front to the sea, for here it is highly probable the sands rest upon chalk hills or cliffs. The site chosen, let



A B C D, be a given area or superficial square, the angle A being towards the most violent action of the waves: at E, the centre of the square, let a circular well about eight feet in diameter be commenced, the masonry about two feet thick to be firmly cemented together, and so secured as to resist the pressure it must experience as it descends. Commencing at the lowest depth convenient, let the building be rapidly carried on until above high water mark, still continuing it as the lower portion disappears, every means being used to facilitate its descent, should this be requisite. There is little doubt, however, of the building gradually sinking, the increasing weight giving the necessary impetus to its descent, and thus must it continue without reference to the depth, until it meet the consolidated bed on which the quicksands rest: this object attained, the sands are then abstracted from the well, and after the foundations are properly examined the whole is to be filled up with solid masonry.

Having by this central well ascertained the depth of sand, and the nature of the lower bed, proceed to form wells of magnitude and strength proportioned to the depth of sand to be passed through, at points, A, B, C, D, and simultaneously or consecutively the connecting well, as exhibited by the accompanying section, to be filled up in like manner: thus a coffer dam of solid masonry will be formed, from the midst of which the sands, if not very deep, may be abstracted, and solid masonry introduced in lieu thereof, binding the whole as one vast solid foundation capable of supporting a noble edifice.

The idea above given, so far as regards building upon quicksands, is not original, for during my travels in India, my admiration has been more than once excited by vast piles of solid masonry having their foundations within the dry quicksand, a much more difficult undertaking I presume, than building upon the Goodwin Sands, which, from their compactness must offer great opposition to the intrusion of bodies of this nature. The beautiful Scotch Church at Madras may also be quoted as having its foundations laid within the quicksand, being pillared on a great number of wells, as suggested by native architects.

The whole of the wells, and the entire foundation being completed,

immense blocks of stone, contributing to bind the whole together, will then be laid upon it, beginning as far beneath the sand as practicable, and continued full twelve feet above high water mark, and upon this the shaft will be raised, the whole superstructure being left to the skill and taste of the engineer. I have only to add that the expence of the wells, however numerous they may be, will be comparatively trifling, and wholly unworthy consideration, taking into account the vast importance of this truly national undertaking.

M.

ENGINEERING IN IRELAND.

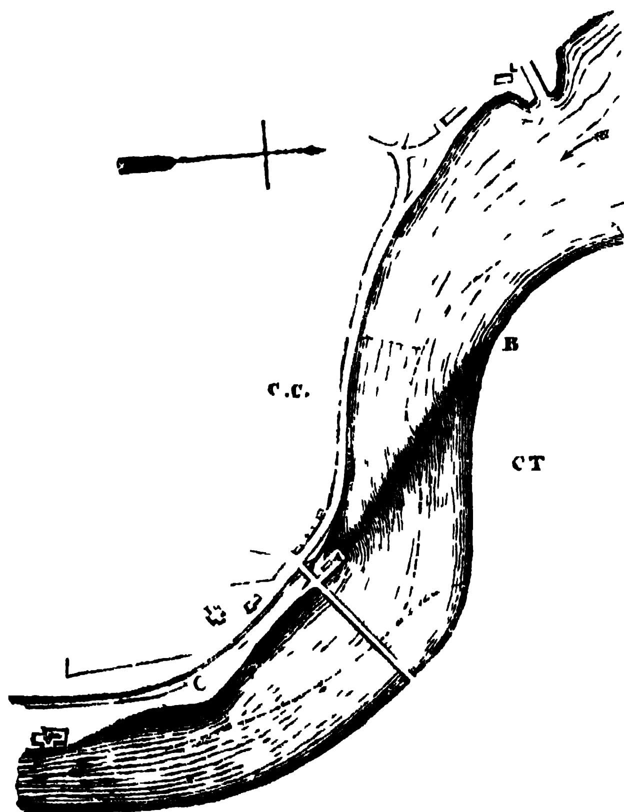
IMPROVEMENT OF THE RIVER SHANNON.

SIR—I shall feel obliged by your inserting the enclosed paper, referring to a portion of the extensive improvements which are in progress in the river Shannon, in the forthcoming number of the *Journal*.

I forward with it a small plan of the site, shewing the weir A. B., and describing (by dotted lines) the three large portions into which the works were divided by dams, for the convenience of their execution.

I am, Sir,
Your obedient servant,
THOMAS BARTON,
Resident Engineer.

Killaloe, County of Clare.
4th Sept. 1843.



Scale, 800 ft. to an inch

REFERENCE.

C C, County of Clare. C T, County of Tipperary. A. B., The Weir. The bridge which crosses the river leads from Killaloe, county of Clare to Ballina, county of Tipperary. C, canal.

On Tuesday, 15th August, Lieut. Col. Harry D. Jones, R.E., Shannon Commissioner, and Thomas Rhodes, Esq., principal engineer, accompanied by William Mackenzie, Esq., the contractor for many of the important works on the line of the Shannon, arrived at Killaloe, and on the following day, inspected the works which are in progress in that beautiful neighbourhood, and are fast verging to completion; after which Col. Jones proceeded on his periodical tour of inspection to the works in the Lower Shannon; having previously visited the Scariff River, where an improvement is carrying on that is likely to be of the utmost advantage to the Towns of Scariff and Touryvaney, and to a very extensive agricultural district surrounding them.

On Tuesday (22nd ultimo) the gallant Colonel returned to Killaloe for the purpose of witnessing on Wednesday, according to arrangement, the admission of the water to that part of the great regulating weir, which had lately been completed, but Old Shannon, grown impatient, would no longer be held in artificial bonds, and bursting forth, resumed his dominion, sweeping with magnificent and easy flow along the improved level of his bed, and thus anticipated the spectacle intended to have taken place on Wednesday.

In October last, a portion of the weir, on the Clare side of the river, amounting to 600 ft. in length, had been finished, and the water being turned over it, dams were made, and the Tipperary side of the river was laid dry for the purpose of reducing the shoal, and constructing the remaining portion of the weir, during which operations the river had been confined to a channel of one half its usual capacity.

The Shannon, at Killaloe, now flows over a line of weir 1100 ft. in length, and it is anticipated that this erection will effect a very considerable permanent reduction of the winter flood, and solve the problem (somewhat difficult to be understood by persons not conversant with the laws of fluids in motion, but which is clearly appreciated by the hydraulic engineer), that a *Bar* or *Weir* may be constructed across a river in such a manner as to obtain an increased discharge.

There is in the apex at the weir, a small deviation of level at one period, so formed as to assist in the annual migration of the salmon, a deep pool being constructed at the foot of the weir, opposite this point, for the purpose of facilitating the leaping of the fish, and at the termination where the weir adjoins to the rock on the Tipperary side, there is a roughly formed inclined plane, by which the young eels, spawned in the estuary, will be enabled to climb the summit of the weir, and pass into the upper waters.

Leaving the question of navigation untouched, some notion may be formed of the improvement likely to result with reference to drainage only, when it is stated that the maximum height of floods at Killaloe, have been known to attain to 9 ft. above the level of the apex of this weir, and that hereafter their utmost height will scarcely surpass three feet above the same datum.

It must be a source of peculiar gratification to Mr. Rhodes, the commissioners' principal engineer, to see, after years of unceasing study and anxiety, that his arrangements are attaining completeness, and evincing success such as could only follow the workings of a genius like his, so particularly fitted to this abstruse branch of the profession, and of which Lord Stanley, (then the Rt. Hon. E. G. S. Stanley) seems to have been so well aware, when, in 1831, he directed this eminent gentleman's attention to *The Shannon! our own Shannon!* the dominant stream of Ireland, and the pride of British rivers!

T. B.

REVIEWS.

Illustrations of the Croton Aqueduct. By J. B. TOWER, of the Engineer Department, (U. S.) Wiley and Putnam, New York and London, 1843.

We have here an elaborate memoir of one of the greatest works of our Anglo-American brethren, a work entailing an expence of upwards of a million sterling, and of that colossal character as to take a high rank among the triumphs of engineering science. It is one of those works which the people of English race on both sides of the Atlantic can look upon with equal pride. We have no doubt that the elaborate and extensively illustrated volume of Mr. Tower will be acquired by many of our readers no less as a record of the Croton aqueduct, than of the high standing which the engineering profession has taken in America, and of the way in which its reputation is mentioned. To do adequate justice to it, it would be necessary to give several illustrations, and we hope at some future time to be able to do this. We make the following extract, to show the reason why the aqueduct form was adopted.

"Having fixed upon the Croton River as a stream possessing the requisite advantages for a supply, questions naturally arose as to the manner in which it should be conveyed to the city. The distance being about forty miles, over a country extremely broken and uneven, and following a direction for a portion of this distance, parallel with the Hudson River, encountering the streams which empty into it and form deep valleys in their courses. It will be interesting to notice the different plans which were suggested for forming a channel-way to conduct the water. The following modes were presented:—a plain channel formed of earth, like the ordinary construction of a canal feeder:—an open channel, protected against the action of the current by masonry:—an arched culvert or conduit, composed essentially of masonry;

and iron pipes. In deciding which of these modes should be adopted, it was necessary to make a comparison among them as to their efficiency for conducting the water in purity, and in the quantity required, their permanency as structures, and their cost.

"The disadvantages attendant upon an open canal were, that by filtration through the banks there would be a heavy loss of water;—the difficulty of preserving the water from receiving the wash of the country, and preventing injurious matter from being thrown into it and rendering it impure, and the impurities which might be contracted by passing through different earths. Evaporation would also occasion a serious loss of water. The banks would be liable to failure in seasons of long-continued rains, and the city depending upon this for a supply, would be cut off, except there should be sufficient in the reservoirs to furnish a supply during the period of repairs. The canal could never be subjected to a *thorough* repair, because of the necessity of keeping it in a condition for furnishing water constantly during the whole year, so that all repairs would be done under great disadvantages, and the channel would be yearly growing worse until its failure might become a public calamity. In regard to the open channel having the sides protected by masonry, the objections were found to be such as would apply equally to every species of open channel; namely, that it would be exposed in many situations to receive the wash of the country; that it would be unprotected from the frost, and liable to be interrupted thereby, and lastly, that there would be a loss by evaporation. It was supposed that these objections might be obviated by certain precautions; for example, the wash could be avoided by making sufficient side drains; and the interruption liable to occur from frost and snow, and the evaporation to a certain extent, could be prevented by closing the channel entirely with a roof over the top. The close channel or culvert, composed essentially of masonry, seemed to possess all the requisite advantages for conducting the water in a pure state and keeping it beyond the influence of frost or any interruption which would be liable to occur to an open channel. In point of stability this plan had a decided preference over either of the other plans proposed, and the only objection offered was the cost of the work constructed in this way. To avoid too great expense it was proposed to make use of a mixed construction, using the close channel or culvert in situations where deep excavations occurred, and it would be desirable to fill in the earth again to the natural form, also where the line of aqueduct intersected villages, and using the open channel with slope walls for the residue of the distance.

"In regard to iron pipes for conducting the water, it was found that a sufficient number of them to give the same sectional area as would be adopted by either of the other plans would be more expensive, and considering the great distance and the undulating surface over which they would extend, other disadvantages were presented which added to the objections, and the plan was considered inexpedient. Could a line be graded so as to give a regular inclination from the Fountain Reservoir to one at the city, then the expense of laying iron pipes for conducting the proposed quantity of water, would be greater than for constructing a channel-way of masonry; and when laid, the pipes were thought to be less durable. Should the pipes follow the natural undulations of the ground, there would be so much resistance offered to the flow of water that the discharge would be diminished in a very great degree.

The close channel or conduit of masonry was adopted as the plan best calculated to answer all the purposes of conducting the water to the city.

We should like the managers of the New River to read this, and see if they could not take a lesson from it with regard to their receptacle for dead dogs, ditch-water, and diseased bathers, with which they supply the metropolis with pure water. The sooner that concern is covered over the better, the more creditable will it be to the managers, and the more acceptable to the community.

Illustrations of Indian Architecture from the Muhammadan Conquest downwards, selected from a portfolio of architectural drawings, from buildings at Agra, Delhi, Juanpur, Benares Chunar, and numerous other places. By Markham Kittoe, Esq. (Parts 9 to 17, containing 21 plates.) Calcutta: W. Thacker and Co., 1838.

To us it affords great gratification to receive these new fruits of Mr. Kittoe's labours, whether we consider them as the productions of a gentleman of great taste and mental culture, or whether we contemplate them with regard to their architectural influence. If there are still those who doubt that no new resources exist for art but in the plagiarism and piracy of Greek design, let them examine these drawings, and see how oriental artists have availed themselves of the wide range of natural objects, cultivated by every real school of art, and neglected by us alone. The Greek, the Roman, the medieval architect, the Moor, was perpetually engaged in the delineation of new forms and the re-adaptation of well-known objects, while we, whenever we tread in the path of antiquity, find nature, as it were, withering beneath our fingers, and presenting no resource but the reproductions of used-up studies. We have protested against such want of industry and want of genius, against such mawkish and thievish degradation of art; and we are glad to be reinforced by arguments so practical as those which are afforded in the works of Mr. Kittoe. If our reader be a lover of the classic or of the pointed style, he will find in the numbers before us numerous beautiful studies from nature, which he may examine with profit. In fact, were several of the plates of the present work laid before the connoisseur, he would be tempted to refer their subjects to the buildings of Athens, or the internal decorations of Pompeii, rather than to the far East. There are candelabra, tombs, arabesques, to which our associations would allow no other birth-place than the Pelasgic lands. On the other hand, there are corbels, brackets, and ceilings, in which we can retrace every lineament of the pointed styles. There is a great west window, which we might think of European origin. If we want to be convinced that art is catholic, and catholic because she must look everywhere to the beauties of nature for her inspirations, we find ample proofs in these records of the labours of those far removed from European sympathies and European studies. We cannot, however, bring ourselves to believe that the monuments of classic genius to be found in western Asia, have been unstudied by oriental architects, and on the contrary, we are inclined to look here for another proof of the vitality of Hellenic principles. We do not believe that those who doted on the labours of Aristotle, and who preserved and reproduced the literary and scientific monuments of Greece, at the same time that they actively cultivated the liberal arts, could have been unimpressed by the material monuments or Greek genius, which were within their reach. We know that bigotry prevented many of the Mahometan literati, the geographers particularly, from availing themselves of contemporary information; but that certainly did not operate with the mass of enlightened and educated men, who showed every disposition to profit by those labours of the Giaours which were within their reach. We therefore believe that the architecture of the Moors was no more without the impress of Greek influence than was their science, and what we have seen in their various monuments tends to confirm us in those views. To the antiquary and to the student of art we therefore recommend these engravings of Mr. Kittoe, for we cannot but believe that it must act as an encouragement to exertion, when it is seen how much has been done by those labouring under less advantages, and possessing less cultivation. Although the monuments described in those parts are principally of the Muhomedan period, yet they abound in features of interest, and Mr. Kittoe is particularly useful in giving numerous examples of details. In one or two of the plates will be found ingenious combinations of the dome and the pyramid or spire, producing a novel and striking effect.

In conclusion, we leave the work to the study of our readers, with an expression of our obligations to Mr. Kittoe for this employment of Indian residence. We sincerely hope that these labours will be continued, and that he will find his exertions have not been fruitless in calling attention to the state of the fine arts in our vast and neglected Indian empire.

Black's Picturesque Tourist and Road Book of England and Wales. Edinburgh: Adam and Charles Black, 1843.

This is an attempt to bring the old road book up to the pitch of modern improvement, and we are bound to pronounce it successful. It is cheap and portable, at the same time that it contains an immense mass of information, closely compressed, and well printed, illustrated with numerous maps and copper-plate engravings. The letter-press appears to be well executed, as are the maps, with the exception of the general map, which is so much neglected, that we feel it our duty to call Messrs. Black's attention to it, as we presume they cannot be aware of its condition, having bestowed so much care and expence in every other department, and maintaining as they do a reputation so high for accuracy and research. We should not, perhaps, complain so much that the Northern and Eastern, and Eastern Counties Railways are left in their original proportions uncurtailed, we might have passed over the omission of all the recent additions to the railway system, the Hertford and Ware, Peterborough, Warwick and Leamington, Oxford and Maidstone branches, but we are sorry to find such numerous and serious omissions as those of the Manchester and Birmingham, Chester and Crew, Chester and Birkenhead, Bristol and Glo'ster, Llanelly, Taff Vale, Gosport, Hayle, and Canterbury and Whitstable Railways, all of which, with one exception, have been some time in operation, and which are to be found in the district maps of this same work. We are further induced to make this complaint from the negligent way in which railway maps, and maps generally, are produced.

The "Prince of Wales" Iron Steam Vessel. Built by Messrs. Miller and Ravenhill, Blackwall.

People are not generally fond of recording misfortunes and mishaps, though such a record would often be productive of great public advantage in preventing the recurrence of such events. Messrs. Miller and Ravenhill know, however, how to make the best of everything, and they have in a lithograph given us a representation of the "Prince of Wales" iron steamer, in a most perilous position.

"The vessel is entirely of iron, and is intended for the Margate station, she is 180 ft. long between the perpendiculars. in launching, the cleets on the bow gave way, in consequence of the bolts breaking, and let the vessel down, so that the bilge came in contact with the wharf, she was ultimately forced off by screw jacks and two tug vessels, cutting her away deeper into the concrete and planking of the wharf, until she assumed the position represented in the drawing, and at that period the distance measured from the face of the wharf to the point of contact of the vessel and the surface of the water was 110 ft., the whole of the deck in the centre of the vessel was left unfastened for the reception of the machinery, when completely afloat, it was found that the shear of the vessel was not broken, and that she had received no injury except that the bow was twisted in consequence of letting go the stern rope, and thus exposing the vessel to the sweep of a strong ebb tide. On examination it was found that three of the angle iron ribs or frames were broken, and one of the plates cracked, occasioning a considerable leak, which was accompanied by no other inconvenience than that of filling the bow compartment as far as the first bulkhead, and after hauling the vessel into dock, the necessary repairs were effected in four days."

This shows what iron steamers can do, and we feel indebted to Messrs. Miller and Ravenhill for giving us this record of an occurrence which only served to test the powers of the vessel in question, and to prove the care with which they had provided for its future efficiency.

The Locomotive Engine, illustrated on stone. By JAMES BASIRE. Jun. London George Hebert.

The designer of these plates has been impressed with the necessity of a better popular acquaintance with the locomotive engine, now that it has become, as it were, a material institution of the country. He has consequently brought forward the present work, which consists of four lithographs drawn in chalk upon a bold scale, representing the external and internal structure of the engine in every detail. We only wish the letter-press had been more copious, however, it will be an acceptable work to those for whom it is intended.

View of the Parish Church of the Holy Trinity, with its proposed Improvements, now in progress By JOHN BLORE, Architect.

This is a beautiful lithograph by Hawkins, and printed by Day and Haghe, in light and shade, the improvements have been judiciously introduced, and will add considerably to the beauty of the church, we could wish to see similar additions to more of our modern cheap-built churches, in which they are much wanted.

OLD LONDON WALL.—We are glad to be able to state that in consequence of Mr G Godwin's representation to the Institute of Architects, and a letter which that gentleman afterwards published in this *Journal*, a memorial signed by Mr. Hudson Gurney Lord Mahon, Sir Henry Ellis, and other office bearers of the Society of Antiquarians, and by Mr Donaldson, Mr Poynter, and Mr. Bailey on the part of the Institute was presented to the Society for promoting the building of churches in the metropolis, and that on the motion of Sir R H Inglis, it was resolved that the wall should be *preserved entire.*

IMPROVED DRAWING SCALES.—Mr. J. Smith, lecturer and teacher of perspective, has invented for the use of the profession drawing scales, formed in box and ivory of very superior workmanship, and at an unusually low price, when compared with those in common use They are divided with great accuracy, and although several scales are upon some of them, there is not that confusion in the figures too often witnessed. No 1 and 4, are arranged for architects, No 2 and 5, for land surveyors and civil and military engineers and No 3, is expressly prepared so as to simplify the practice of isometrical perspective, a system of drawing which ought to be in more general use than it is at present

IMPROVEMENTS ON BROMIELAW HARBOUR AND RIVER CLYDE.

THE following interesting description of the works that have been executed on the River Clyde, and for which we are indebted to the *Glasgow Herald*, shows what continuous exertions directed in the right way will do in effecting improvements of rivers, there are several of our most important ports which might be equally improved, now being silted up, and which in a few years will be almost useless as harbours.

"We are delighted," says the Glasgow Herald, "to observe the rapid progress made the last two months in the works which have been for a considerable time in operation for the improvement of the harbour at the Broomielaw, and which, when completed, will most amply supply the wants of the Glasgow trade for years to come. The works upon which the Clyde Trustees, by means of their able engineer, have of late been bestowing their principle attention are—first, the new harbour below Napier's Dock; second, the new timber and small craft wharf, between the Glasgow and the Accommodation Bridges, third, the additional timber wharf at the Glasgow Bridge for river steamers, and, fourth, the cutting of a new deep channel through the Port-Glasgow bank. Having seen the state of the works so recently as Saturday last, (Sept 16) we should say that all of them will be finished within a week or ten days from this day, and some of them finished, too, in a manner so massive and substantial, that they promise to resist the action of the elements, and the wear and tear incident to the operations of commerce, for ages to come. The accommodation within the harbour will then stand as follows —

	Feet.
Length of quay walls on the north side of the harbour . ..	3700
Length of quay walls on the south side of the harbour	2300
The new quay in the course of formation on the north side, below Napier's dock	560
The new timber wharf in the course of formation on the north side, between the bridges	530
Total accommodation at the Bromielaw ..	7050

In addition to this a rubble dyke has been formed on the river-side ground recently acquired below Todd's mill, which, by the excavations made, has added a space of 100 ft to the breadth of the river for 800 ft downwards, and from which 25,000 cubic yards of earth have been removed in the course of the excavations This, it may be observed, is only the commencement of a series of operations which will eventually have the effect of widening the harbour from 160 ft (its present breadth at the Kinning-house Burn) to as near as may be 100 feet throughout The excavations at this spot have already extended to nearly low water line, but in due course it will be further operated on and deepened until there is at least 12 ft below low water line, which at high water, in ordinary tides, will at all times afford from 19 to 20 feet in the harbour In addition there is the basin at Bowling, 10 miles below the Broomielaw, which is employed for the laying up of large ships and steamers during the winter months The basin contains an area of 14 acres The extension of the harbour between the bridges for small craft is generally looked upon with much satisfaction. It has been long battled for and is now effected

"The weir which so long obstructed the navigation at the Glasgow Bridge is now been as near as may be removed, and a new weir has been placed down at the Stockwell Bridge for the maintenance of the top level of the river for the purposes of the Water Company at Dalmarnock. The removal of the old weir has been very rapidly effected, considering that 15,000 cubic yards of stone and earth have been carried away, and from 500 to 600 piles drawn. The depth of water already obtained between the Bridges at full tide is 11 ft, and now that the weir is nearly removed, it will afford accommodation for timber rafts, and all the small craft of whatever tonnage It is not unlikely, therefore that the time is not far distant when the river steamers will be provided with tumbling funnels, as upon the Thames and the small craft with folding masts, so that the benefits of steam navigation and of commerce may be brought almost to the heart of the city

"The operations during the last and present summer, in cutting a channel through the long obstructing Port-Glasgow bank, have been of the utmost importance to the navigation of the river. The cut formed by the dredging machines extends to about 700 yards in length, by 400 feet in breadth, and the result is, that while there is now a depth of 12 ft. of water at low tides, there is no less than 22ft 6 in. at high water in spring tides. Last year not fewer than 90,000 cubic yards of stuff were excavated in making the cut through the bank, and this season the excavations amount to 70,000 cubic yards, giving a total of 160,000. When it is remembered that this bank was one of the greatest obstructions in the river, and that there have been sometimes from 10 to 15 vessels lying aground on it, we cannot too heartily rejoice at its removal Since last summer there has not, so far as we know, been a single vessel impeded in its course in sailing over or through the new channel and when we mention, that this season the Commodore, a large ship in the American trade, sailed up the Clyde to the Broomielaw, drawing 17 ft. 9 in. water, it will give one instance, out of many, of the length to which the capabilities of our river now extend. In addition to the benefits which will be derived from the cut in the Port-Glasgow bank itself, it will vastly facilitate the navigation of the river in other respects, permitting the

upward passage of a vastly additional quantity of tidal flow. We cannot conclude these remarks without bearing our warm testimony to the liberality and enterprise of the members of the River Trust, who have directed and the ability of Mr. Bald, their engineer, who has planned and executed, these stupendous works, and when we consider that within a comparatively recent number of years, more than half a million of money has been sunk in these operations, and that the revenue varies from £42,000 to £47,000 per annum, we may well say that there is scarcely a similar instance on record of such vast enterprise and such rapid advancement."

ORDNANCE SURVEY.

We are not of those who entertain prejudices against or for the Royal Engineers or any other class, we are staunch supporters of that eminent body, when engaged in the discharge of their legitimate duties, but we could not have been so many years employed in watching the interests of both military and civil engineers, without seeing that a very general attempt has been made to introduce the government officers as competitors with their civil brethren. Government no more wants an exclusive corps of civil engineers than it wants an exclusive corps of architects or lawyers but as a matter of economy, it is of course right that it should avail itself of the services of the military officers at its disposal for its own works It is, however, quite clear as a settled principle of political economy that it is most dangerous for a government to meddle at all with the general market of labour. When a corps of officers is kept up at the national expense greater than is required for the discharge of military duties, and work has not only to be made for them, and to be made at the expense of private professional parties, it becomes a great grievance The want of adequate responsibility of the royal engineers, and the evils attendant upon their employment where they are not required, is well shown in the following letter and it must be obvious to every man of common sense that their employment in the Ordnance Survey, of England, Ireland or London must have the same ultimate effect, upon the members of the engineering profession as the employment of paupers from workhouses to ruin the existence of the poor sempstresses and shirtmakers, about which so much outcry has been made At the present moment there is a greater dearth of employment in the engineering profession and its subsidiaries than at any former period, and when a legitimate occasion for occupation occurs it is to be given to men who have no impulse to adequate exertion, and no pecuniary penalty to check their errors or their ignorance We say with the writer, that this state of affairs claims redress

TO THE RIGHT HONOURABLE SIR R PEEL, BART

Sir—It appears by the Parliamentary reports in the newspapers, that you have moved for leave to bring in a bill relative to a survey and the construction of maps, on a large scale, of the city of London I trust it will not be deemed an impertinent intrusion on my part to make a few observations in connexion with this undertaking

It has not yet been formally declared who the parties are that will be entrusted with the execution of this important work, conjecture, however, has awarded it to the Royal Engineers, acting nominally under the Board of Ordnance. I have watched the proceedings of these men for years with a lively interest; early associations have, in some measure, excited that interest and kept it alive. Being intimately acquainted with their modes of operation, and enabled thereby to form correct conclusions relative to their value as practical men, I now come forward to deprecate the measure which would entrust to them the survey of the city of London, and to contend for the propriety of its being left open to competition.

You, doubtless, will be furnished with an estimate of the time and expenses necessary for the execution of this work. I can readily believe that if estimates were the data which would determine your choice of parties, the Royal Engineers would at once crush the pretensions of all competitors, but permit me to ask, have the estimates heretofore made by the Royal Engineers relative to works of this nature, proved correct? It is most notorious that they have not. You are aware that the survey of Ireland has been executed by these persons, this undertaking was commenced in 1824, the estimated time for its completion being seven years, and the estimated expense £300,000; did subsequent experience prove the truth of this? No, it proved its utter fallacy; you, perhaps, will be surprised to hear, that far from bearing out the previous estimate, the scientific operations of these seven years were almost, if not entirely, useless, the maps and other documents proved so grossly incorrect—so utterly unfit for the purpose for which they were designed, that the greater part of them were ordered to be destroyed. Thus, Sir, and for these reasons were the materials which bore the impress of the concentrated talent of five captains and twenty-five lieutenants of the Royal Engineers, for a period of seven years, reduced to their primitive elements. the survey of the island was not completed till 1842, and it incurred an expense little short of three quarters of a million sterling.

But a specious objection may here be started—it may be said that the above would be unfair premises whence to draw conclusions relative to the *present* claims of the Royal Engineers, inasmuch as they were at the time alluded to comparatively inexperienced. I shall not wait to discuss the merits of this plea, but I shall meet the objection on its own ground. In 1841, an act was passed for the survey of the six northern counties of England, the estimated time for its execution being six years; two years of this time have already elapsed, and there is not one county finished yet. The expense, up to the present time, is about £120,000, or £60,000 a year, the quantity surveyed at present amounts to about 2,000,000 acres, and before the mapping and calculation of this will be finished, three years will have expired. We are here furnished with data to find the expense of this survey, and the time of its completion. The contents of the six northern counties are,—

Northumberland	1,197,440 acres
Cumberland	974,720
Westmoreland	487,680
Lancashire	1,180,240
Durham	702,080
York	3,835,040
Total ..	8,327,200 acres

Then, by a plain statement in the rule of three, if 2,000 000 acres require three years for its completion, 8 237,200 acres will require about twelve years. So that though the Act contemplates that this survey will be finished in 1846 7, it will not be completed till 1853, and will incur an expense of £700,000

You may now judge, Sir, what effect the experience of the Royal Engineers has upon their estimates And will you, Sir, permit the continuance of such an expensive system at a period of such financial embarrassment as the present? Let an examination be made before the House of Commons into the past history of the Ordnance survey of Ireland, and the history of the Ordnance survey of England, which is at present in a state of progress—let persons be examined who will give plain facts as to the progress of the work and the outlay of public money—let some of the most intelligent of the Royal Sappers and Miners, and assistants, be examined before the House, and afterwards you can judge of the propriety of entrusting to the Royal Engineers the survey of London Captain Boldero's reply to a question lately asked by Lord H Vane proves that there exists on the part of the Government gross misconception relative to the present state of the survey of the six northern counties The proceedings of the Royal Engineers have ever been mysterious, in 1835 an Honourable Member moved for an examination into the state of the Ordnance survey of Ireland but Sir H Vivian assured the Honourable Member that the work was getting on rapidly, and that an examination would only cause dispirit. When this assurance was given the Ordnance surveyors were plodding their weary way over a district, the survey of which had been previously executed so incorrectly as to need a complete revision

Since their arrival in England the Royal Engineers have adopted a line of conduct which strikes at the very vitals of a respectable profession—they have entered into a most unfair competition with the civil surveyors of England, I refer to their contracting for the surveying of townships for tithe commutation their estimates of which work are so low as to wither in the breast of the civil surveyor every hope of successful competition But Sir, in point of accuracy, they may be ranked with the other estimates spoken of —they are utterly false I challenge contradiction when I assert that the *actual* expense of the tithe plans executed by the Royal Engineers is far beyond the *estimated* expense, *so that the public service must suffer from such undertakings*

Now, Sir, contrast the case of these men with that of a body of civil surveyors similarly circumstanced the latter have a professional character at stake—the former need not rely on theirs The Royal Engineers may calculate on their salaries, maugre all their blunderings—the civil surveyors have no such prop The Royal Engineers have a ready salvo for each mistake—the public purse is their panacea—the civil surveyors have nothing but their talents to bear them out, and a single error such as those which are so common with the Royal Engineers would injure their professional character for ever

These, then, Sir, are the grounds on which I contend for the survey of London being left open to competition I am satisfied that the civil profession are able to do it as correctly, as quickly, and more cheaply than the Royal Engineers Let engineers and surveyors put in tenders for certain sections of the metropolis, all to be executed on a uniform system,—let all parties be bound to a certain time,—let the Ordnance surveyors put in their tenders also, but let them stand on their own merits—let them have no funds to fall back on as heretofore, in case of failure, let their own pecuniary loss be the result of any error in their estimates, and the issue will prove that the civil profession are able successfully to compete with them.

I would not have you infer from what I have stated that the Ordnance survey is altogether wanting in point of talent, I am free to admit that there are many intelligent, respectable men connected with it, but I do contend that the treatment which these men receive is sufficient to wither all their energies. It has been the boast of individuals in high places that they can procure the best draftsmen in Europe at the rate of 2s. 6d. and 3s. a day. I willingly admit that at the present moment there are first-rate draftsmen on the Ordnance survey who are condemned to toil for this miserable pittance. but does [illegible] individual "glory in his shame" who would thus make a boast of his ability to crush merit? and I appeal to you, Sir Robert, what interest will a man of talent take in that situation the pecuniary emoluments of which amount to no more than 2s. 6d. or 3s. a-day, and even that much lessened by travelling and other expenses incidental to the employment of the operative Ordnance surveyor? I could abundantly prove the [illegible] system of economy which would treat deserving men thus and I could show that the best, and ultimately the cheapest [illegible] would be to make a situation on the Ordnance survey worth holding, to pay the men sufficient property, and thus excite in him an interest in the [illegible] to him for execution.

[illegible] the present 'mis of the survey is the employment of [illegible] still lower rate of pay than the above [illegible] of whom are utterly [illegible] the [illegible] great majority of these [illegible] of [illegible] description. If the [illegible] I could detail to you the sufferings of numbers of individuals [illegible] having been turned from their [illegible] have been dismissed without a [illegible] from their employment and thrown upon the world [illegible] and penniless, [illegible] whose [illegible] to the name of Irishman. I could [illegible] the [illegible] Ordnance surveyor craving, at the Workhouse [illegible] and more than one repulsed as an impostor. I [illegible] the faithful servant of the [illegible] in December the [illegible] and now lies [illegible] body [illegible] his life.

I know there [illegible] the credibility of what [illegible] anonymous [illegible] they [illegible] Englishman employed in the Ordnance survey [illegible] the paltry meed which the [illegible] The Ordnance survey [illegible] been taken [illegible] of these men, and the [illegible] their [illegible]

[illegible] the report [illegible] in the course of [illegible] that I have forgotten [illegible] which I commenced [illegible] of the machinery of the Ordnance survey, and the [illegible] which the [illegible] employed [illegible] will [illegible] strengthen [illegible] what I have before stated [illegible] and that therefore [illegible]

Dublin, [illegible] 1843.

Election of City Surveyor.—A court of Common Council was held on the 19th of September for the purpose of electing a clerk of the works [illegible] of Mr. Montague, deceased, when Mr. Bunning was [illegible] majority over Mr. Young, who had been several [illegible] in Mr. Montague's office, of 38 votes. The numbers were—

For Mr. Bunning	106
For Mr. Young	68

Steam Plough on [illegible] Moss.—Lately Mr. Curtis, the eminent engineer, invited about 20 of his friends to witness the machinery connected with the plough set in motion, and it was truly astonishing to see such an immense [illegible] travel with the greatest facility over ground so soft that a man [illegible] stand upon it without sinking. Mr. Curtis politely explained the objects of the different parts of the machine, and so far as an unprofessional person can judge the principle of the construction appears sound, and we have no doubt that when completed (which it will be in a short time), it will fully answer the purpose.—*Dumfries Courier.*

[illegible] Land from the Sea.—The sea banks at Long Sutton, Lincolnshire, under Sir John Rennie's direction, are now nearly finished. The contractor for the work is Mr. Henry Sharpe.

RAILWAY CHRONICLE OF THE MONTH OF SEPTEMBER.

This month has been distinguished by the amalgamation into one concern, of the three midland lines, the North Midland, Midland Counties, and Birmingham and Derby. Special meetings for that purpose were held on the 18th, 20th, and 21st, when resolutions in favour of the scheme were passed almost without opposition. The terms are, that the capital and debt of the united company should be distributed according to the following scheme.

	Capital.	Debt.	Total.
North Midland . ..	£2,905,400	£863,000	£3,766,400
Midland Counties	1,275,000	581,000	1,856,000
Birmingham and Derby ..	978,500	411,000	1,389,500
Total	5,158,900	1,855,000	7,013,900

The shares to be converted into stock, and the profits to be divided *pro rata* except that the Birmingham and Derby is to receive 27*s*. 6*d*. per cent. per annum less dividend. An incidental question arose at the Birmingham and Derby meeting as to the eighths shares which had been issued at a very great discount, but which had not all been called up. The holders of eighths claim that the whole shall be called up to entitle them to the benefits which would have accrued to them had the whole amount of money been required. It was pretty generally agreed that they ought to have £8. 3*s*. 5*d*. per £1 10*s* paid up, but what they claim is £10. 18*s*. 11*d*. for £2. 7*s*. 5*d*. paid up. The question is put off till a future date, when it is supposed the holders of eighths will rest satisfied with what they have got. At the Midland Counties meeting the Chairman very clearly showed that that Company would be placed in a more disadvantageous position than it would have been under any of the schemes formerly proposed and rejected. The majority, however, felt that they were obliged to submit to the new terms. The effect of the amalgamation is to create a Company, which adds another to the number of colossal railway institutions and which stands thus —

	Capital and Loan.	Length opened in miles	Annual traffic.
Great Western	£6,670,000	190	£750,000
United Midland	7,013,000	178½	400,000
London and Birmingham *	7,000,000	119½	800,000
Grand Junction	2,464,000	119	360,000

It will thus be seen that the London & Birmingham is hard put to it to keep the pre-eminence, and that a number of gigantic companies are being created in the country, into which all minor lines must sink. Within three years there will be perhaps not more than half a dozen railway companies in the country, and the new system will develop some extraordinary results, particularly as to economy. The saving on the United Midland line is estimated at £30,000 per annum, besides a considerable revenue to accrue from better arrangements of the trains.

The half-yearly reports of the two other companies we gave in our last number; that of the Birmingham and Derby, not then published, presents no very extraordinary results. The estimated amount of savings to be effected was upwards of £7000 a year.

Edinburgh & Glasgow Railway.—This Company have adopted the plan of making up their accounts to the 31st of January, and 31st of July of each year, instead of 31st of December, and 30th of June, by which the half year's accounts made nearly equal in receipts, but the present accounts show 7 months' income and expenditure. The dividend recommended was at the rate of 2½ per cent per annum. A junction line was in progress to the Monkland and Kirkintilloch to cost £3000.

Hull and Selby Railway.—This report states a diminution in the passenger traffic, and an increase in the goods, the accommodation for which had required further provision.

Taff Vale Railway.—The Taff Vale meeting was a stormy one, and the report particularly as it was to receive the report of a committee of inquiry into the conduct of the concern. It appeared pretty clearly that the undertaking had been grossly mismanaged, and there appears little prospect of its improvement for a great part of the capital is held by the proprietors of the neighbouring collieries and iron works, whose interests seem to be opposed to those of the shareholders. The owners require a further reduction in the tolls and the shareholders require an augmentation of the tolls.

Dublin & Drogheda Railway appears to be progressing favourably, and its success is likely to be the best railway measure for Ireland, by inducing private capitalists to make investments there. A difference having taken place with the Ulster Railway as to the width of rails, it was referred to the Board of Trade, and General Pasley has recommended a gauge of 5ft. 3 in., a most extraordinary measure, and seemingly not having very powerful arguments for its support. Mr. Mac Neil, C.S., is having about 4 miles laid with permanent rails, on which he means to try some experiments as to the best forms of carriages and engines for working the line. He holds out hopes of some new results.

The Great Western has a considerable length of line yet to be opened, and the capital and loan do not include the cost of the Bristol & Exeter, Bristol & Gloucester, and Cheltenham & Great Western.

* The London & Birmingham has about 47 miles of branch still to open.

South Western.—The accounts of this Company showed a slight increase in the traffic, but the savings in the working expenditure had been counteracted by the great increase in parochial rates. The dividend was 30*s.* per share for the half year. The main features of the discussion which took place were relating to the parochial rates It seemed to be felt that no other mode of checking this oppression existed than a combined application of the Railway Companies to the legislature for an amendment of the present law in relation to the subject

Greenwich Railway Company—After all the meetings chronicled in our last, and the adoption of the mileage principle, a final meeting upset the whole proceedings, and the question of toll remains *in statu quo*, the committee of inquiry being summarily dismissed The Directors have, however, since offered to the Croydon Company, a modified toll of 4*d* for each first class passenger, 3*d* for each second class passenger, and 2*d* for each third class passenger, which has we believe been refused, the other companies trusting to the effect of the Bricklayers' Arms branch to bring the Greenwich to their senses

Manchester and Birmingham Railway—The dividend recommended here was 15*s* per share There had been an increase in the income, and a diminution in the expenditure The Directors had been making some experiments with cheap fares, which had fully answered their anticipations, and they were about to apply the principle to a greater extent

Maryport and Carlisle Railway—This line is not yet finished and the secretary, a Mr Mitchell who was a country school-master having ousted the engineer, has installed himself in that capacity too, so that the profession is likely to see some strange performances The traffic, and the whole concern is in a wretched condition but the reports published do not admit of articulars being given

Glasgow Paisley, Kilmarnock & Ayr Railway—The passenger traffic s reported to have remained stationary the goods to have advanced The Kilmarnock branch was opened on the 4th of April an arrangement with the competing canal company had been effected The subject of steam boats in connexion with the railway, was recommended to the proprietors, but nothing effective seems to have been done. The proceedings principally relate to this subject, and the means of effecting a saving in the working expenses

Glasgow, Paisley & Greenock Railway—The proceedings of this Company at their half-yearly meeting were much the same as those of the preceding. Steam boats had already been taken into connexion with the Company, but further measures were urged

West London Railway—The works on this line were reported at the half-yearly meeting to be going on well, and the opening is promised for November The total disbursements are £174,867.

London and Croydon Railway—The half yearly meeting of this Company was marked by a long exposition from Mr Wilkinson of the conduct of the Croydon Board as to the toll transactions, and the announcement of the Greenwich offer alluded to above The traffic had of course, in the state of the toll question, shown no improvement

Manchester and Leeds Railway—At this meeting a general increase in the traffic was announced, as also an arrangement with the Calder & Hebble Canal Company, which had been competing for the traffic. A complaint was made here also of a great increase in the parochial rates The dividend was at the rate of 5½ per cent per annum, and the works on the extension line and Halifax branch are reported as going on well, the Halifax branch to be finished in the spring Surveys have also been made for branches to Huddersfield, Ashton, Bury and Bradford, which are likely to be prosecuted. This company it seems, is threatened with a competition by the way of the Sheffield & Manchester from Penistone to Barnsley

Yarmouth and Norwich Railway—This company have expended £49,072, and the works are represented as in a forward state, so as to get the line open by June next year It seems that the estimates are likely to be exceeded by £12,500, in consequence of some landowners' claims which the Company has been obliged to satisfy at this meeting measures were taken for promoting a line from Norwich to Brandon

TABULAR STATEMENT FOR THE HALF YEAR, DECEMBER 31, 1842, TO JUNE 30, 1843

RAILWAYS				RECEIPTS			PAYMENTS							
Names	Lgth in mls	Total Expenditure	No of Passgrs	Passgrs	Goods	Total	Locomotive Power	Carriage Dep	Maintenance of way	Office Depart-	Taxes and Rates	Total Charges	Interest	Profit.
		£		£	£	£	£	£	£	£	£	£	£	£
Greenwich	3¾	1,030,108	705 201	21 315		26 587	3 500	3 190	1 011	1 551	3 301	13 957	11,550	1,080
Grand Junction	98¾	2,375 131		132 976	19 652	155 093	20 298	29 192	12 675	4 591	2 951	80 320		104,772
Manchester and Bolton	10	777 956	139 108	11 571	6 293	17 811	1 095	3 110	732	754	268	5,959	5 282	9 008
North Union	22	613 212		17 731	6 713	25 337	1 166	2 112	1 171	1 236	1,082	7 397	3,249	14,690
Chester and Birkenhead	14½	509 810		11 191	1 298	13 [illegible]	2 110	2 38	1 089	[illegible]37	172	5 990	2,525	2,837
Leeds and Selby	20		[illegible]	3 756	8 158	11 914		1 251	567	114	177	2 [illegible] 9		9 175
Brighton [1]	46	2 792 193		65 187	9 002	74 190	9 168	18 150	1 980	3 117	3 003	19 8[illegible]7	13,974	
North Midland	72	3,121 766		86 551	16 263	102 814	10 267	1 9[illegible]	1 012	1,100	2 659	[illegible] 760	21 200	14 8[illegible]4
Northern and Eastern Counties	32	887 055		31 853	3 693	35 547	6 702	[illegible]	2 033		895	20 324	5 695	10,875
London and Birmingham	112¼	5 953 831		306 157	84 755	390 [illegible]8	32 [illegible]1	11 111	451	5 [illegible]	8 747	112 238	39 680	223 921
Midland Counties	57½	1,725,693		40 421	21 004	6[illegible] 21	10 780	9 198	7 105	3 583	1 3[illegible]5	32 141	12,813	17 367
Great North of England	71	1,230 604	64,177	19,754	13 225	32 979	2 830	3 197	3 700	1 811	1 194	12 335	11,202	7 000
Sheffield and Rotherham	5¼		185 231	7 010	953	8 116		2 107	186	371	420	3 384	1,199	3,578
Bolton and Preston	14¼	373,925		3 816	1 168	[illegible]	2 000	1 170	185		92	3,447		1,867
Great Western [8]	118¼	6,651 928	725 127	254 603	75,400	330 003	33 403	51 640	23 985	4,118	8,592	159 232	86,856	82 886
Liverpool and Manchester	31	1 578 601	225,728	60,752	48,217	108 960	10 182	27,698	1 110	2,193	3 608	18,121	3,777	57,062
Blackwall	3¼	1,289 080		17,551	927	18 506			600		1 498	15 385	5 553	
Eastern Counties	50¼	2,718 620	909,683			4[illegible] 182	4 551	3 741	2 552	1 284	1 520	20 355	2 116	20,710
Birmingham and Gloster	55	1 470 730		35 514	7 104	12 618	7 968	6 956	6 114	1 290	382	26,015	13,633	4,266
York and North Midland	27¾	673 056	165 6[illegible]7	26,369	13,388	4[illegible] 163	[illegible]846	[illegible]115	1 177	462	971	13,604	3 958	27,600
Birmingham & Derby	48	1 17[illegible] 158		19 191	9 791	29 282	6 015	6 701	3 676	2 296	7[illegible]	19 118	7 512	2,323
Edinburgh & Glasgow	46	1 569 887	318 682	41 225	18 581	60 809	5 687	11 328	3 756	1 129	333	22 575	12,168	26,106
Hull & Selby	31	627 626	80,549	12 359	13 668	26 027	3 490	5 027	1 893	937	704	12 043	5 061	9,910
South Western	92¾	2,588,993		116,700	26 326	14[illegible] 523	18 451	27 859	13 579		5 238	65 128	15,827	69,386
Manchester & Birmingham	10	1,890 640		37 673	6 644	50 149	3 516	8,175	1,345	1,787	1 17[illegible]	16 301	13 254	20,593
Maryport & Carlisle	28			584	3 090	3 675						11,588	2,053	33
Glasgow & Ayr [11]	51	1,029 662	175 012	22,191	9 181	30 372						15,151	7,204	9 328
Glasgow & Greenock	22¼	635,512		20,176	6,853	27 029						17,042	6,173	6 215
Croydon [12]	8¾	672,630	102,143			20 922		6,145	2,152	1,173	390	10,160	1 029	9 166
Manchester & Leeds	51	3,125,696	5[illegible]2,639	56,951	53 610	112 523	12 758	13,793	6 751	2,085	5,141	40,528	35,747	36,248
Hartlepool [13]	15					14,708						21 529		20,116

[1] Greenwich Railway received for foot passengers £497 and toll £4 746 [2] Grand Junction paid Liverpool and Manchester Railway £8 016, and for rent £2 093 [3] Leeds and Selby locomotive power is included in York and North Midland [4] Brighton paid Croydon and Greenwich Railway for toll £11 109 [5] Northern and Eastern paid Eastern Counties Railway for toll £3 749 It should be observed that the office expenses cannot be separated [6] London and Birmingham paid Aylesbury Railway for rent £1 250 In addition to the total outlay there is the sum of £13,966 carried to the depreciation fund [7] Locomotive power not kept distinct [8] Great Western paid Bristol and Exeter and Cheltenham Railway for rent £34 484 In addition to the outlay £5 000 is carried to the depreciation fund

[9] The carrying and office or general department cannot well be separated in the South Western Company [10] The accounts of the Maryport and Carlisle Company do not allow further information to be given [11] Part of the Glasgow and Ayr, and Glasgow & Greenock being a joint line worked in common, it is impossible to divide the items of expenditure [12] The Croydon accounts being divided into a toll account and a traffic account, the table of income cannot be divided. [13] The Hartlepool accounts have not been published

Northern and Eastern Railway.—A meeting of this Company has been held for the purpose of authorizing a loan of £67,822 for the extension to Newport. At this meeting it was announced that measures were in progress for an extension to Brandon, so as to make a complete line from London to Norwich and Yarmouth.

REGISTRATION OF DESIGNS ACT.

A new act of Parliament came into operation on the first day of September last, which promises to be of some benefit for many purposes, but not to that extent, we think, which some of our contemporaries imagine, as the articles only obtain a protection so far as the *configuration* goes. The act does not in any way protect a principle; therefore, if the article manufactured partake of the form of a circle, and another article for the same use be made in the form of an ellipsis, there will be no protection. The following is the principle clause of the act:—

And with regard to any new or original design for any article of manufacture having reference to some purpose of utility, so far as such design shall be for the shape or configuration of such article and that whether it be for the whole of such shape or configuration or only for a part thereof, be it enacted, That the proprietor of such design not previously published within the United Kingdom of *Great Britain* and *Ireland* or elsewhere shall have the sole right to apply such design to any article or make or sell any article according to such design for the term of three years, to be computed from the time of such design being registered according to this Act, provided always that this enactment shall not extend to such designs as are within the provisions of the said Act, or of two other Acts passed respectively in the thirty-eighth and fifty-fourth years of the reign of His late Majesty King George the Third, and intituled respectively *an Act for encouraging the art of making new models and casts of busts, and other things therein mentioned and an Act to amend and render more effectual an Act for encouraging the art of making new models and casts of busts and other things therein mentioned*.'

The following is the Table of Fees which since the passing of the Act has been authorized by the Lord Commissioners of the Treasury

	Stamp £	s	d	Fee £	s	d	Total £	s	d
Registering Design	5	0	0	5	0	0	10	0	0
Certifying former Registration	5	0	0	1	0	0	6	0	0
Registering and Certifying Transfer	5	0	0	1	0	0	6	0	0
Cancellation or Substitution				1	0	0	1	0	0
Inspecting Index of Titles				0	1	0	0	1	0
Inspecting Designs (expired Copyrights) each volume				0	1	0	0	1	0
Taking Copies of ditto each Design				0	2	0	0	2	0
Inspecting Designs unexpired Copyright) each Design				0	5	0	0		

We know not upon what authority a £5 stamp is inflicted by the Lords Commissioners, not one word in the act authorises it; we therefore contend, that they have no power to order one to be affixed, and that if the Registrar refuses to register a design without the £5 stamp, upon the fees being tendered, he will, no doubt, render himself amenable to the law for damages, and that, if an application be made to the Court of Queen's Bench, it will grant a *mandamus* to compel him to register and certify.

LIST OF NEW PATENTS.

(From Messrs Robertson's List.)

GRANTED IN ENGLAND FROM AUGUST 31, TO SEPTEMBER 28, 1843.

Six Months allowed for Enrolment, unless otherwise expressed.

Charles Louis Felix Franchot, of Arundel-street, Middlesex, engineer, and Cyprien Marie Tessié du Motay, of Arundel-street aforesaid, gentleman, for "*an improved method of connecting and laying pipes or vessels beneath the surface of water, for the purpose of forming therewith tunnels or viaducts for the conveyance of passengers and goods*."—August 31.

George Catlin, of Queen-square, Bloomsbury, Middlesex, artist, for "*improvements in the construction of vessels for navigation designed to prevent the loss of life in cases of shipwreck or other accidents at sea*."—September 4.

William Thomas, of Cheapside, merchant, for "*an improved fastening for wearing apparel, and which may also be applied as a fastening to portmanteaus, bags, boxes, books, and other things.*" (A communication.) September 6.

Alexander Spears, of Glasgow, merchant, for "*improvements on or appertaining to glass bottles proper for wines and other liquids.*" (A communication.) September 6.

Pierre Pelletan, of Fitzroy-square, Middlesex, Esq., for "*improvements in the production of light.*" September 6.

William Dauly, of Hans-place, Sloane-street, bricklayer, for "*improvements in the construction of fire-places, flues, and chimneys.*" September 21.

John Baptist Wickes, of Leicester, framework knitter, for "*improvements in machinery employed in the manufacture of framework knitted and looped fabrics.*" September 21.

George Robert D'Harcourt, of Argyll-street, Middlesex, gentleman, for "*improvements in sorting, checking, and delivering letters, newspapers, and other articles.*" September 28.

Omitted in last month's list.

John Charlton, of Birmingham, factor, for "*improvements in castors for furniture.*" August 17.

MISCELL.

Midland Counties Railway.—The platform across the Trent at the Weir, building by the Midland Counties Railway Company, has all been carried away by the floods; the works are going on slowly, and in a different manner from the first operations.

Canals in France.—A canal is now in progress in the south of France, under the direction of Mr. Thomas Woodhouse, C.E., formerly resident engineer on the Midland Counties Railway.

Manufacture of Bricks.—A description of brick is made in the neighbourhood of Nottingham called copper mould. They are compressed after partial drying in hacks; the arris is very sharp, and equal to dressed bricks.

Derby Drainage.—The Commissioners intend to apply to Parliament for a new Improvement Act, and several plans have been proposed for improving the drainage, relieving the town from flood waters, and improving its present dangerous and unhealthy state. Two reports have been published, one by Mr. Harrison and another rather lengthy by Mr John Roe, Assoc. Inst C E.

Steamers on the Trent.—A twin boat is building at Lenton, to ply between Nottingham and Gainsborough, to carry both goods and passengers.

Newcastle on Tyne. An opposition boat is to start between here and London to compete with the General Steam Navigation Company, the fare to be 30s instead of as at present 42s.

Edinburgh.—A tunnel is being driven from the present terminus of the Newtyle Railway to the centre of the market place; and a line has been projected to Berwick, under the auspices of Messrs. Grainger and Miller, engineers.

Dundee.—The east church adjoining the Steeple Kirk, which was burnt to the ground about two years ago, is now beautifully restored, and will be shortly opened for use; it is in the florid Gothic style, and of excellent workmanship.

Sir Walter Scott's Memorial.—It is now completed to a short distance above the arches, which carry the cross or about one-third of the whole height; the situation, on the south side of Princes Street, is well chosen, and when complete it will be the boast of Scotland as to masonry.

Incorporated Companies.—At the head meeting day of the company of house carpenters, a vote of thanks was passed to Mr. Henry Glynn, for a present of five pounds worth of books, being the *Civil Engineer and Architect's Journal* from its commencement in 1837.

St. James's Palace.—We understand that the whole suite of State apartments, at St James's Palace, is about to undergo an extensive and thorough repair, cleansing, and decoration. It is expected that the apartments will not be again ready for royal use for several months, probably not until the early part of next spring.

The Princess Alice.—A new iron steamer, built by the well known firm of Messrs Ditchburn and Mair of Blackwall, for the Folkestone and Boulogne station made a trial down the river Thames, on the 2nd ult.; she is 12 ft. long, 20 ft beam, and draws 6 ft. 6 in of water, and is built with water-tight bulk heads, as all steamers ought to be; her lines are very fine and of that form which is sure to obtain a good velocity. The engines are 120 horse power collectively, and have the annular cylinders patented by Mr. Joseph Maudslay, drawings of which are to be found in our *Journal* for 1841, Vol. 4, p. 369. The object of this form of engine is to obtain direct action and a long stroke, but we are no admirers of the principle, nothing but the superior workmanship of the firm of Messrs Maudslays & Field could ensure its working; in such an exposed station as crossing the channel she will have some rough work to encounter. The wheels are 19 ft. 3 in. diameter to the extreme edge of the boards, they are a modification of Morgan's wheels, excepting they have three of the boards connected in such a manner that by the aid of an eccentric on the shaft, the paddle boards enter and leave the water vertically; these wheels are similar to those fitted on board the "*Victoria and Albert*." There is another addition to these wheels which we understand Messrs. Maudslays have fitted to other vessels, consisting of an iron ring of the same diameter as the rim of the wheel; it is fixed on the inner side of the wheel; this ring is jagged, and formed like a thin cog wheel, and is turned by means of a pinion worked by one or two men on deck to each wheel; by this means a vessel might be got out of dock without getting up the steam. At the trial of the vessel the engines made 30 to 31 strokes per minute, and it is stated to have obtained a rate of 14 miles per hour. Her engines are fitted with an alarum whistle which we have seen adopted at some of our provincial ports.

ADVERTISEMENTS.

SEYSSEL ASPHALTE COMPANY, "Claridge's Patent." Established March, 1838.—The extensive patronage which this valuable MINERAL production continues to receive from the most eminent ARCHITECTS and ENGINEERS in this country and abroad, distinguishes it from the numerous fictitious compositions which its reputation gave rise to, but which having been found very inferior to the original material, most of them have ceased to be used. Its merits being well known, it is only necessary to refer to a few of the public works already executed and now in progress.—On the London and Greenwich Railway, and Joint Station London Bridge, 430,000 superficial feet; several thousand feet at the Great Western, Birmingham, Midland Counties, South-western, Brighton, Blackwall, and other Railways, covering of Arches at the South Metropolitan Highgate, and Nunhead Cemeteries, the covering of the Casemates at the Perch Rock Battery, Liverpool; the Pavement in Whitehall, the Carriage-drives at the Horse Guards, and at the entrances to the Park by Apsley House the Cells and other apartments of the new Prison at Hereford, several works at the Stations on the Dublin and Kingstown Railway, and many other public and private works in different parts of England, Ireland, and Scotland

A Scale of Prices, with Books of Testimonials, can at all times be had at the Company's Depot, where specimens of its various applications may be seen.

J. FARRELL, Secretary.

Seyssel Asphalte Depôt, Stangate, near Westminster Bridge,
March, 1843

FROM "THE TIMES"

December 5, 1842

"Many of our readers may, perhaps, remember that some years ago, and previously to the introduction of Asphalte into this country, we expressed our admiration of the pavement, composed of that substance, in Paris, and especially of that in the Place de la Concorde, the whole of which has been long since paved with Asphalte It now behoves us to point out the piece of Seyssel Asphalte laid down in April, 1838 in Whitehall opposite the Horse Guards, as equal to the pavement in the Place de la Concorde, or in any part of Paris, and considering that its thickness is only half an inch, its having so long stood the traffic of so great a thoroughfare, without any apparent change, except a greater smoothness of surface, is very remarkable"

CEMENT—MOST IMPORTANT AND VALUABLE INVENTION.

TO ARCHITECTS, ENGINEERS, CONTRACTORS, BUILDERS, MASONS, PLASTERERS, and THE TRADE and also to SHIPPERS THE PATENT STUCCO PAINT CEMENT, surpassing every article hitherto introduced, possesses the following extraordinary and valuable properties Remarkable adhesiveness, fixing most tenaciously to the smoothest surfaces (even to glass). It is perfectly impervious to *wet* or *damp* the more it is exposed to the atmosphere the harder and more durable it becomes It is perfectly free from any of the caustic qualities of lime, and it may, therefore, be painted upon as soon as dry, as it is impossible that it can vegetate or change colour, nor can it be affected by FROST or HEAT, or crack, chip, or peel off To merchants and shippers it must form a most important item of commerce, as it will keep for any length of time as fresh as delivered from the manufactory With regard to price it is cheaper than any other cement, and its lasting qualities render it a fortune to builders and others investing capital in building speculations. The patentees have appointed Messrs Mann and Co 5, Maiden-lane, Queen street Cheapside, their sole agents, at whose warehouses any quantity may be had, specimens may be seen, and every information afforded

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KALSOMINE WASHABLE PAPER-HANGINGS AND DECORATIONS—These Paper Hangings are of every variety, and though not higher in price than ordinary papers, possess the valuable quality of washing and cleaning with *soap* and *water*, whereby light and cheerful patterns, so easily soiled by a London atmosphere, become as economic as the darker and more covered papers Every pattern manufactured by the London houses may be obtained at the same prices at W. B Simpson's, decorator. 456, West Strand

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TO ARCHITECTS, Builders, &c.—The advantages of J. FINDON's improvement of WATER CLOSETS—the great facility of acting, cleanliness, durability, and readiness of being connected to a pipe from a head of water, which pipe may be used for any other purpose, the whole of the apparatus being under the seat. Testimonials to be seen at the factory 190½, High Holborn N B Hoppe's Closet, with earthenware basins and trap complete 23s if iron enamelled basins and trap, 25s Iron cisterns, bends, connecting pieces, and traps to fit the iron soil pipes very cheap

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PATENT TRANSPARENT VENTILATORS.—The increasing patronage afforded to this invention, which has been extensively introduced into the palaces, public offices, most of the principal banking and club houses, and many private houses, warehouses, offices, &c. has induced the proprietors (FAIRS & Co) to an effort for their more general adoption; in furtherance of which they have prepared a graduated and greatly reduced tariff of prices, which will be forwarded, post-paid, on application to Fairs and Co, 22, Mortimer street, Cavendish-square; the Factory, 15, Gillingham-street, Pimlico; or Messrs Bunnett and Corpe, 26, Lombard-street, where orders are also received. Fairs and Co are also Manufacturers of the Improved Zinc Sashes, now so extensively used for churches and other buildings, which supersede the use of copper, at a much less cost, and in which the most elaborate designs may be executed.

CAEN STONE.

THE AGENTS for the best ALLEMANGE STONE from CAEN have a regular supply; a stock of which may be seen at at Freeman's Wharfs, Millbank-street, and Deptford.

PAYNE'S WOOD PATENT.

THIS PROCESS FOR PRESERVING VEGETABLE SUBSTANCES, WILL RENDER

- WOOD Thoroughly Anti Dry-Rot
- ,, Uninflammable.
- ,, Of the most inferior quality equal in point of Strength, Durability, and Usefulness, to the hardest and best description
- ,, Unassailable by Insects.
- ,, Sufficiently seasoned for any use in a comparative short time
- ,, Elastic when required
- ,, So granulated in its surface (and throughout the body) as to prevent pavement, in a great measure, from being slippery.

The combinations are insoluble, and are mostly of such trifling cost, as scarcely to be appreciable as articles of expence where the work is considerable.

Hence, for Ship and House-building, Public Works, Piers, Sleepers for Railroads,—Engineers', Coopers, and Millwrights'-work,—Wood Pavements, Cabinet work Hop Poles, and wherever Wood is used, the advantage of this process must be apparent.

The patentee is now ready to undertake orders for the preparation of timber under this process and is authorized to state that his invention having been minutely investigated by Richard Phillips, Esq , the eminent Chymist, by order of the Hon Commissioners of Woods and Forests, they have been pleased to adopt it in some of the works now in progress under their management. Particulars for the use of this Patent, whether by License or otherwise, to be obtained at the

OFFICE —*No. 2, Parliament Street.* WORKS —*Whitehall Wharf, Cannon Row.*

THE PATENT

FIRE PUMP AND ANTI-FRICTION PUMP.

THEY are both simple and cheap, and are not so likely to get out of repair as the Common Pump The Fire Pump combines, without any alteration, the Common Domestic Pump, the Lifting Pump, and the Force Pump. The Anti-Friction Pump is well adapted for DRAINING LANDS The Fire Pump is adopted by Her Majesty's Board of Works, and one is fixed in the House of Commons.

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Where may be had Water Closets of every description from 25s, suited to all situations —Portable and other closets for exportation.

INCORRODIBLE IRON AND WIRE FENCES.—J. PORTER Grove Iron Fence Works, Southwark, and 77, Cornhill, In addition to his usual strong iron fences, is prepared to supply all kinds of IRON FENCE, garden wire work cast and wrought iron balcony, and every description of iron work connected with his business, GALVANIZED upon M Sorel's well established principle, by which means not only is their durability secured, but their disfigurement from rust prevented Galvanized iron buildings, roofs, &c , fixed in any part of the kingdom, or prepared for shipment to the East or West Indies, &c. Hurdle six feet long five rails, 5s 6d each, other sizes in proportion The trade supplied.

LAWRENCE & CO, 55, PARLIAMENT STREET, WESTMINSTER and 10, YORK PLACE, LAMBETH, Successors to the Patentees and Manufacturers in Zinc to her MAJESTY THE QUEEN DOWAGER. Original makers of Malleable Sheet Zinc Bars, and Wire, Drawers of Tubes and Sash-bars Perforated Zinc, for Larders, Safes, and Blinds. Roofs and Verandas covered with Zinc Rain Pipes Chimney Pipes, Cowls, &c. Gutters, Ridges, and Sky Lights. Baths and Zinc Door Plates Garden Lights, Wardian Cases, and Conservatories

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PAPER HANGINGS.—A very close imitation of muslin, upon paper, with elegant patterns worked thereon, suitable for superior bed-room decorations and other purposes An imitation of superfine cloth manufactured to the size of the walls of rooms, without joint or seam, by the original Inventor and Patentee, who can supply the perfect article at less cost than the very inferior imitations which have been attempted. This article, as manufactured by the Inventor, has, from its first introduction, received the most distinguished patronage His late Majesty, George IV, and many of the Nobility and Gentry, have acknowledged it to be one of the most perfect decorations ever brought forward.

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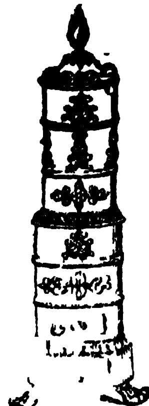
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PATENT SELF-FEEDING [illegible] STOVE.



[illegible] STOVE [illegible]

[illegible] combustion, and have [illegible]

[illegible] 7/3 [illegible]

[illegible] 1842.

[illegible] Church [illegible]

[illegible]

[illegible] Churches [illegible]

[illegible]

Warden [illegible]

[illegible] WALKER, [illegible]

[illegible]

[illegible] 1842.

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[illegible] Agents [illegible]

ENCAUSTIC or INLAID ORNAMENTAL TILES, for Paving Churches, Halls, [illegible] WYATT, PARKER, [illegible] Co. [illegible] to [illegible] Westminster, Winchester [illegible] Church, [illegible] Malvern, &c. [illegible] P. and Co. also have [illegible] colours [illegible] Specimens may be seen at Wyatt, Parker, and Co.'s wharf, Holland street, Surrey [illegible] of Blackfriars bridge.

VASES, TAZZAS, FIGURES, &c.—WYATT, PARKER, and Co. [illegible] Vases, Tazzas, [illegible] &c. [illegible] Also [illegible] Keene's marble [illegible] Holland street, Surrey foot of Blackfriars bridge.

FRENCH DECORATIONS AND PAPER HANGINGS.

[illegible] and Choice Designs in every style [illegible] every celebrated Continental Manufactory.

MARKS & CO., of 59, Princes Street, Leicester Square, beg [illegible] the new Patent [illegible] Rooms [illegible] the finest [illegible] Paper [illegible]

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BUNNETT AND CORPE,

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No. 26, LOMBARD STREET, LONDON,

PATENTEES OF REVOLVING IRON SHUTTERS

and of

IMPROVED BRASS AND ZINC SASH BARS AND MOULDINGS FOR SHOP FRONTS,

Which [illegible] and much cheaper [illegible]

STALLBOARD PLATES, [illegible] BRASS WORK for the Trade.

Estimates given and contracts [illegible] for PATENT IRON SHUTTERS, METALLIC SHOP FRONTS, SASHES, &c. glazed complete with best plate glass in any part of the kingdom.

Several [illegible] HIGH PRESSURE STEAM ENGINES to be sold, or let, [illegible] SAWING AND OTHER MACHINERY [illegible] adapted for Building purposes [illegible] the Patentee's works, Deptford, Kent.

[illegible] Patent [illegible] Ventilators.

KEENE'S PATENT MARBLE CEMENT.

THIS Cement, which exceeds all others in hardness, is intended for [illegible] strength and dispatch in execution are required. [illegible] mouldings, &c., [illegible] vermin.

For the Flooring of Entrance Halls, Offices, Churches, Chapels, &c., will be found to be warmer and materially cheaper than stone, from which it is hardly to be distinguished either in hardness or appearance.

When used [illegible] it dries rapidly, and may be painted [illegible] within a few days.

The [illegible] takes a brilliant polish [illegible] marble in richness and depth of colouring.

This material is now being extensively used in Government and other works, both public and private, to which the patentees can with confidence refer.

Patentees and Sole Manufacturers, J. B. WHITE & SONS, Millbank street, Westminster.

Agents for its sale are established in Liverpool, Manchester, Edinburgh, Dublin, Cork, and the principal towns in the United Kingdom.

NOTICE.—PATENT RELIEVO LEATHER HANGINGS and CARTON [illegible] Office, 52, Regent street, next to the County Fire Office. The Nobility and Public are respectfully informed that our Works of Art in the PATENT RELIEVO LEATHER, [illegible] can henceforward only be obtained from the firm of [illegible] and Co., 2, Regent street, where an immense number of designs are constantly on view and sale [illegible] Hangings of Rooms, Cornices, Friezes, Arabesques, Panels, [illegible] Letters, Busts, Mouldings, [illegible] Screens, & [illegible] in every style [illegible] this firm only [illegible] all new patterns and designs [illegible] L. COMMITTI and Co., 10, Rue Basse [illegible] Rempart, Paris, May 25, 1842.

BY HER MAJESTY'S ROYAL LETTERS PATENT.

GERISH'S PATENT DOOR-SPRINGS, FOR CLOSING EVERY DESCRIPTION OF DOOR.—Manufactory, 16, East Road, Hoxton New Town.

These springs consist of parallel and rising hinges in Brass or Iron, and swing centres for doors opening both ways.

These improved spring-hinges or door springs merit general attention, as they can be applied to any door in every situation, without lettering the wood work; their action is easy and noiseless, neat, and not visible when the door is shut, and are made to surpass the best now in use for nearly one half the price; they allow the door to [illegible] quite back, and are not likely to get out of repair.

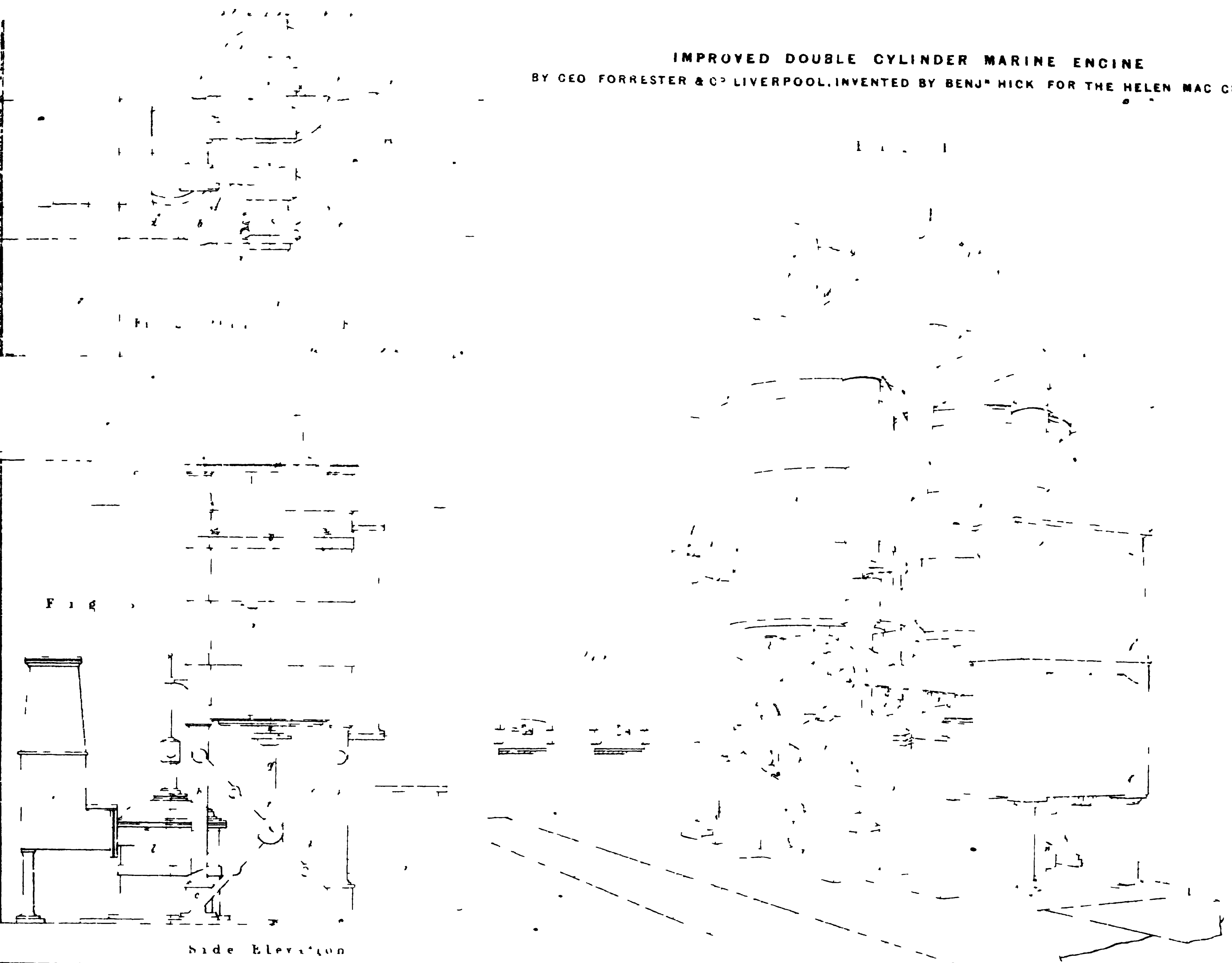
The Swing Centre possesses in a simple combination of power double the strength of any hitherto invented, in a much smaller size, and at little more than half the expense.

DAVIES' RAILWAY CARRIAGE BREAK.—The attention of Railway Directors and others is earnestly solicited to the important advantages realized by Davies' Improvements in Breaks for Railway Carriages. Davies' Break having been thoroughly tested on the London and Birmingham Railway, is now extensively employed upon that line. Although this Break is the most powerful hitherto employed, from its gripe being on the opposite side [illegible] of the wheels, it throws no strain upon the axles. It is applied almost instantaneously, and has no tendency to fly off when left to itself; its action is perfectly silent, and the application of the Break wholly imperceptible [illegible]

All who are interested in the *safety* or *comfort* of railway travelling will do well to examine this Break at D. Davies's Repository for Improvements in Carriages, 15, Wigmore street, Cavendish square.

IMPROVED DOUBLE CYLINDER MARINE ENGINE

BY GEO FORRESTER & Co LIVERPOOL, INVENTED BY BENJn HICK FOR THE HELEN MAC GREGOR.



DIRECT ACTION ENGINES.

(With an Engraving, Plate XIII.)

Description of a pair of GEORGE FORRESTER & CO.'s *improved Double Cylinder Marine Engines, constructed by them, and fitted on board the "Helen Mac Gregor," Hull and Hamburgh steamer. Engines invented by* BENJAMIN HICK, *of the above firm, Liverpool.*

These engines are of the form usually denominated "Direct Action Engines," but differing considerably in arrangement, and possessing many advantages over the various forms of direct action engines hitherto made.

The collective power of the engines is 220 H.P. The accompanying engraving represents a perspective view of one of the engines when looking towards the boiler, with part of the boat in section. Each engine consists of two inverted cylinders, *a a*, mounted upon four strong wrought iron columns, *b b*, &c., which are secured at the lower ends to the foundation plate *c*, and passing through suitable boxes on the sides of the cylinders, and secured by means of nuts at their upper ends immediately to the entablature plate and crank pedestals, *d*, above. The cylinders stand "athwart ships" with their stuffing boxes, *e e*, looking downwards, and at such a height from the bottom of the vessel as to allow the main cross bar, *f f*, which connects together the two piston rods, *g g* to work the full length of its stroke below them the stuffing boxes are made double, that is, they have a space for packing, both top and bottom, and are fitted with self-acting oil cups for lubricating the rods. *h*, is a long connecting rod, by means of which the power is transmitted directly from the main cross bar below, to the crank, *i*, above the cylinders. In order to ensure an equable action of the two piston rods and their connecting cross bar, they are further secured and made to work uniformly together, by means of a strong cast iron vibrating frame forming part of the parallel motion, and which, with side levers, K K, serves also to work the air-pump, *l*, as well as the feed pump, *n*, bilge and brine pumps. The paddle shafts, *p*, wheels, and bearings, are constructed in the usual manner. The slide valves are of the usual, D, form. The condenser, *m*, is placed immediately underneath the slide valve case, and the air pump, foot and discharge valves, are arranged as shown, being very similar to those of the ordinary side lever engines. The connection between the air pump and condenser is underneath the foundation plate, *r*; *o*, is the hot-well from which the waste water is discharged by an overflow pipe through the vessel's side in the usual way. The cross forming the support of the side levers is of wrought iron. When working, these engines are remarkably steady, there not being the slightest perceptible tendency to motion in any part of the framing It is well known that in all reciprocating engines, of whatever form or construction, the *parts of the engine subject to the greatest strain, are those which lie between the point at which the cylinder is secured, and the centre of the crank shaft, to which the power of the engine is communicated* hence in this engine, the only portion of the framing through which the power of the engine is transmitted, is from *s* to *s*, and there is no other part of the engine framing whatever subject to the strain of its power, except *the short space intervening the two points*. The elevated position of the cylinders also secures them from liability to *water from the boilers*, as they are at a higher level than the water line; and accidents from the above cause (to which marine engines are frequently subject) cannot occur. The space occupied by the cylinders is so much above the engine house floor, that there is considerable more space below than in the ordinary engine, to get round about the working parts, which are all below, and occupy a comparatively small space underneath each set of cylinders; both the upper and lower covers of the cylinders are removable, and by taking off the upper ones only, there is clear room (without the intervention of the piston rods) to examine and clean the pistons, or adjust them, without disturbing the stuffing boxes below, or uncoupling any further part of the engine. The position of the *condenser* and air pump is such, as to render them accessible on all sides, and the condensers being directly below the slide valves, the exhaustion is rendered more immediate and perfect, by its proximity to the openings of the cylinders. The *connecting rods* are necessarily of *great length*, and the strain and consequent friction to which engines with short connecting rods are subject, is thereby overcome. The motion of the air pump, as in the side lever engines, is effected *upwards* whilst the pistons are descending, and the weight of the air pump, bucket, cross head, &c., counterbalance that of the connecting rod and its appurtenances. There is a clear passage between the engines, below the cylinders, on the engine floor, and from this point all the working parts of the engines are within reach of the engineer. The *saving of weight and space* is very great as compared with that of the ordinary marine engine. The total length of room occupied by the above engines and boilers and 60 tons of coal, is only 34 ft. 6 in. from bulkhead to bulkhead. The centre of gravity of engines and boilers is not higher than that of the ordinary marine engines, and the saving of weight renders that of engines, boilers, and boat considerably lower.

It may be observed, that in principle of action there is nothing new in these engines, steam of 5 lb. pressure is used in the boiler, and the slide valves cut off steam at three-fourths of the stroke. The novelty consists merely in using *two inverted cylinders*, and in the particular mode of disposing the different parts, and so arranging them, as to confine all the requisites for a more effective and durable engine with the greatest possible saving of weight and space.

The boilers are of the tubular form, and are the first of the kind made at Liverpool, they generate an abundance of steam, and have brine pumps attached. An apparatus is fitted to each fire-place for consuming the smoke, upon the principle of admitting heated air.

The following are some of the principal dimensions, &c, of the engines —

Cylinders, 42 in. diameter length of stroke, 4 ft. 6 in.

Air pump, 33½ in. diameter, length of stroke, 2 ft. 4½ in.

Capacity of condenser, including passage to air pump, 11 cubic ft.; ditto of hot well, 36 cubic ft.

Wheel, 23 ft. 6 in. diameter, to the outside of floats.

Number of revolutions, 23½.

Pressure of steam in cylinder, 3¼ lb.

The vessel is of iron, and one of the strongest hitherto constructed. She is divided into five compartments by strong water-tight bulkheads, her speed by the log during a late trial trip, was 12 knots, (engines making 23 revolutions per minute,) and having 200 tons of coals and cargo, dead weight, on board.

Dimensions, extreme length, 175 ft., breadth, 25 ft. depth, 16 ft., burthen, 03 tons draft of water with 100 tons dead weight, 11 ft.

This vessel is the last of between 50 and 60 built by Mr. John Laird, who, we are happy to hear, has now on the stocks an iron frigate of 1100 tons for Her Majesty's service, as well as several for the Honourable East India Company, and other parties.

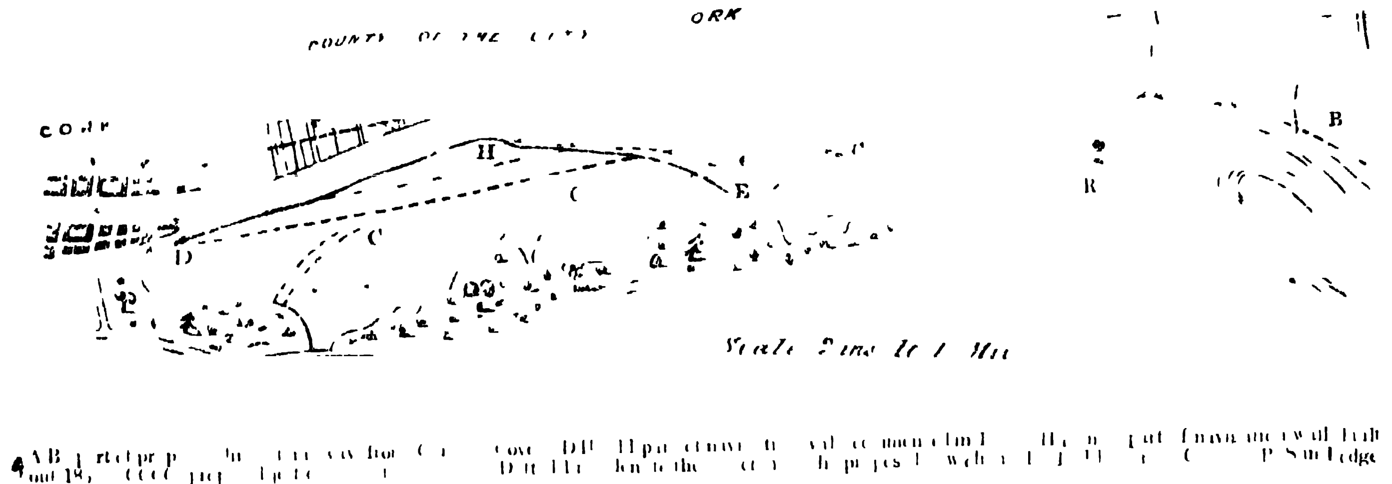
REMARKS UPON THE PRESENT STATE OF THE HARBOUR OF CORK AND THE RIVER LEE

COMMUNICATED BY GEORGE WHITE, A.I.C.E., &c.

THE eligibility of Cork as a harbour is so generally known, that it would be superfluous, on the present occasion, to dwell at any length upon its merits. It may not, however, prove uninteresting to take a short notice of its capabilities as a place of refuge. Considering the spaciousness, security, and other advantages which this harbour possesses, it appears difficult to account why Waterford should have received such favour in the late inquiry before a select committee of the House of Commons, instituted for the purpose of determining the most proper station for a mail communication with the south of Ireland,[1] the latter being, as is well known, a bar harbour, having only ten feet water over it at low spring ebbs, besides other disadvantages, with which nautical men are well acquainted

Cork is the only place on the south coast of Ireland fit to accommodate ships of the line, with the exception of Bantry Bay. There are, perhaps, few natural harbours so perfectly devoid of danger; the

[1] See Evidence of William Preston White, Esq, Harbour-master, in the Parliamentary Reports of 1842.



AB, part of proposed railway from Cork to Cove. DH, [illegible] wall built about 1800, CCC, [illegible] DH, [illegible] P. Sutledge [illegible]

only obstruction of any note (if such it can be called) is the Harbour Rock, which is a pinnacle of such small dimensions as to be easily removed by blasting; accidents are, however, of such very rare occurrence, as to render such a precaution unnecessary. The soundings outside the mouth of this harbour are so regular, as to enable ships to run for it in thick or foggy weather by using the lead, an advantage which Waterford does not possess, the entrance being very rocky, and the soundings consequently irregular. The accommodation which Cork is capable of affording is great beyond conception, as many as 500 sail of vessels having frequently enjoyed its shelter. Its store houses are on an extensive scale, occupying the greater portion of the Island of Haulbowline. The most interesting part of the subject, however, in an engineering point of view, is the river, which it may be advisable to pass on to, rather than dwell upon the advantages which nature has so lavishly bestowed on this harbour.

The River Lee, the subject of the present memoir, rises on the confines of an adjoining county (that of Kerry), at a considerable distance from Cork. It does not, however, become of sufficient importance to be considered in connexion with the navigation until it approaches a large weir within a mile of the city, which has been erected for the purpose of damming up the river, the town being supplied with water from this place, which, as may be expected, has the effect of doing the navigation considerable injury. The river is here divided into two branches, which do not again unite until they reach the Custom House, a part of which is marked on the accompanying plan, D. Before proceeding to describe what has been effected in the deepening of the channel by the dredging operations constantly going on, it may be useful to take a cursory glance at the various proposals which were made to improve the navigation. The first attempt worthy of note appears to be the building of an embankment or wall, marked DH, for which the Irish parliament advanced £4000 in 1760. It was erected for the purpose of confining the flood waters of the Lee, and in this way it was expected to keep the river from filling up. However well it may have preserved that portion of the channel along which it was formed, it appears to have done so at the expense of other parts, for large deposits of mud were constantly taking place below it, and the navigation was becoming so much obstructed from shoals, that it was found necessary to consult Mr. Alexander Nimmo, and to invite him to report upon the best means of removing the increasing evils. Accordingly we find this eminent engineer, in 1815, complying with this request by making a most elaborate survey of the river, accompanied with a report.

The principal works suggested by him appear to have consisted in forming a still-water navigation, one end of which was to have terminated in the deep water of Lough Mahon, below Black-rock Castle, the other at some waste land near the Custom House, which he proposed forming into wet docks, for which purpose the locality appeared to offer peculiar advantages. The expense of such an undertaking (about £160,000) at a time when the funds of the corporation were by no means great, was most probably the cause of this proposition not being adopted. It has not been marked on the accompanying sketch, fearing that it might have become confused from the smallness of the scale. It was likewise intended that the present channel should have been deepened by dredging so as to admit vessels of greater burthen to come to the quays. He was also of opinion that the building of an embankment at the north side of the channel, where it bends towards the King's Quay, would have been most beneficial. The position of this wall would be well represented by supposing the present embankment, HF, removed to the other side of the channel. There can be no doubt that such a work would have been most advantageous to the navigation, as the current on the ebb setting in the direction of this embankment would have the effect of materially keeping the channel. It would also afford an opportunity of reclaiming nearly 200 acres of waste slab, which, from its proximity to the city, would, in course of time, become valuable property, and handsomely repay the expense in a measure. From its running parallel and close to the channel, vessels could have used it as a towing-path until they came up as far as the old wall DH. It is much to be regretted that Mr. Nimmo's recommendation in this particular was not followed; expense in the present case cannot be pleaded as an excuse, as we find the harbour commissioners building such an embankment, HE, but unfortunately at the wrong side of the channel. It would require no very great amount of foresight to perceive that the erection of such a work in such a situation would have been attended with the most injurious consequences to the navigation. This does not appear, however, to have occurred to the Cork Harbour commissioners; for a line of railway from Cork to Passage being then in contemplation, we find them proposing to continue this wall for the purpose of carrying the railway over it, the projectors of which, it would appear, considered the railway of much more importance than that the navigation of the river. The scheme, however, not succeeding, the wall was not finished, and in this condition it now remains, a monument of disgrace to its projectors.

About the same time a railway was proposed from Cork to Cove, a part of which is marked AB on the plan. The promoters of this speculation appear to have had the improvement of the river more at heart, for we find in the report a plan proposed for the improvement of the navigation by Mr. M'Neil, in which the subject is treated with his usual ability. The principal improvements consisted in cutting a new channel, as represented by the parallel dotted lines, from the Custom House to Black-rock Castle; this would be nearly a straight line, and it was intended that the embankment for the railway should have formed a great portion of its northern boundary, to which might have been added a towing-path for the accommodation of vessels. It may be well to premise that this new channel was to be cut entirely through the slab, which consisted of a material well suited for filling up the embankment. The works were thus to be carried out in concert, each being made subservient to the other, and the expense would have necessarily become in this way very much reduced. The part of the wall represented as being cut in two places by the new channel, and which it would have been necessary to remove, would have gone towards forming a barrier at H. The northern boundary of the channel would, under this arrangement, have been well defined. At the south side it will be seen that there is a great extent of slab, probably from 300 to 400 acres in extent, over which the tide ebbs and flows twice in every 24 hours. This vast body of water, which may be regarded as the possession of a power of great value, was proposed to be usefully employed by scouring the channel; this was to be effected by building jetties (marked CCC, &c., on the plan), over which the water was to flow at every half tide, which, returning on

the ebb tide, would be directed by the jetties towards the north wall, and thus materially tend to deepen the river. It would also be attended with the advantage of keeping up for a considerable time a depth of water in the channel, which could not otherwise be maintained. The effect upon the channel of such an operation constantly going on would speedily be felt in the improvement of the river. It was also proposed to make a wet dock of the old channel for a space of 600 or 700 yards, in the direction of DH, capable of affording accommodation for 100 sail of vessels. This could have been done at a comparatively trifling expense. The space of ground, H, before referred to, between the new and old channels, would be peculiarly suitable for ballast quays, affording opportunities for supplying ballast in the wet docks, or to vessels lying in the channel. Having now taken a short but accurate review of what has been proposed as improvements for the navigation of this river, it may be well, before bringing these remarks to a close, to notice the effect of the dredging operations constantly going on. We find, at the time Mr. Nimmo made his report, that vessels drawing more than ten or eleven feet water were not able to go up to the quays of the city during spring tides, and with neap tides not higher than the King's Quay. From constant dredging the bed of the channel has been very much deepened, for vessels drawing eighteen feet water are now enabled to come up to the quay during ordinary springs in one tide, which they were before unable to do in consequence of being obliged to wait below the Flats (a shallow some distance from the Meelagh Bank), until nearly the top of high water, the consequence of which was that, by the time they arrived near the King's Quay the tide was too low for them to proceed further, and were consequently obliged to wait until next tide, a circumstance in many cases attended with no small inconvenience. A channel having been now cut through the Flat, this inconvenience has, in a great measure, been remedied. These have always been considered as the most formidable obstacle to the improvement of the navigation. The channel, since it has been cut, has at this place undergone very little change, which is so far encouraging. The dredge-boats are at present employed in cutting off an angle of the Meelagh Bank which projects much into the channel when this is accomplished, the greater part of the impediments to the navigation below Black-rock Castle may be said to be removed. The straightening of the channel as far as practicable has been at all times a desideratum. The most obstinate shoal in the river above Black-rock Castle is in a part of the channel a little below the end of the embankment, H E, before referred to this it has been found necessary to dredge away several times since the building of the wall, and it is probable, from its so quickly accumulating, that it would before long become a field of corn, were it not for dredging, which will, as long as the wall remains, be continually necessary, as the cause must be removed before the effect can cease.

The slab behind the embankment, DHL, is, as may be expected, constantly filling up with mud, which is occasionally again dislodged after heavy rains, and deposited in the channel It will be evident, from what has been already said, that dredging can never be entirely dispensed with in this river under existing circumstances.

The commissioners do not appear to exert themselves in this matter as much as they ought, probably owing to the fact, that a portion of the material raised is very suitable for ballast, which, being in great demand, pays a great portion of the expenses incurred in raising it. From the returns made by the Ballast Office it appears that from 17,000 to 18,000 tons of this river clearance is annually supplied to vessels leaving the port, which is paid for at the rate of a shilling per ton, leaving a clear profit, after paying dredging, lighterage, and other expenses, of about sixpence per ton.

The quantity of material which the boats on this river are capable of raising is very variable, being entirely dependent on the nature and depth of the cutting, it being possible to raise a much greater quantity of gravel than clay in the same time. The largest boat, which is about 16-horse power, has raised as much as 60 tons of mud and gravel in 26 minutes, this, however, must be considered as a maximum, and worked under the most favourable circumstances. The average expense of dredging may be estimated at from 2½*d.* to 3*d.* per ton.

Hoping these remarks have not been extended to too great a length, we must now bring them to a conclusion before doing so, however, we cannot help remarking that, had the various sums expended from time to time (in building embankments and other useless works) been judiciously spent under competent advice, the necessity of dredging would most probably be altogether done away with after the channel had been once formed. On few rivers has so much been done by nature, and so little by art.

SUGGESTIONS FOR THE MORE EXTENSIVE EMPLOYMENT OF CONCRETE

(Concluded from page 158.)

In a former paper on this subject will be found the particulars of a dwelling house constructed entirely of concrete. As this is only an example out of a great many others in which this substance has been employed in France, for general building purposes, it cannot fail to excite astonishment that it has never yet been tried in this country for building cottages and dwelling houses of the humbler class. The price of concrete is less than one-third that of either brick or stone, so that the proprietor of the soil or the speculating builder would effect a great economy by introducing it. It is deplorable to see in many parts of this rich and highly favoured country—to say nothing of the unhappy sister kingdom—those miserable mud hovels in which the honest labourer is compelled to rear his family. And yet there is no hope of amending such a condition of things unless some material be substituted, which possesses the solidity and durability of brick or stone, without at the same time being nearly so expensive as either of these. Such a material is concrete with respect to the two former qualifications, while in point of expense it can probably be built at least as cheap as a good wall of mud. The construction of mud walls, in fact, although common in many of the northern counties, in Scotland and in Ireland, has never been practised amongst us with the same degree of skill, nor with the same success as in France, in southern Russia, and in many parts of Asia. In those countries the method of building *en pisé*, as it is called by the French, has been carried to considerable perfection, by skill in the tempering and puddling of the clay, and by mixing with it various ingredients, such as chopped straw, hair, &c., which increase its strength and cohesion. It is important to observe, however, that wherever building *en pisé* has been successfully practised, there has been the advantage of a nearly tropical sun to bake and indurate the newly formed walls. On the other hand, in this country, the walls of mud, however well formed, are subject to destructive atmospheric influence, before they can well be hardened, and it is therefore no wonder that they are far inferior to the *pisé* walls of warmer climates.

CONCRETE AS A FOUNDATION FOR ROADS.

The first account we have met with of the use of concrete for this purpose, occurs in Hughes' *Treatise on Roads.*[1] It appears to have been used by him on the Highgate archway road, under Mr. Telford's direction, as long ago as the year 1828. Mr. Hughes' practical experience on this subject is extremely valuable, as he tried on the same road another kind of concrete foundation, made of Roman cement and gravel, and although the latter is of course far more expensive, he decidedly gives the preference to lime concrete, owing to its greater toughness and its consequent capacity of resisting fracture. His proposal for the use of concrete in the roads round London is worth quoting, and we entirely agree in the propriety of it —"I should recommend for all the principal roads round London —after all the supplies of water from the sides as well as that falling on the road have been properly intercepted by longitudinal side drains and transverse ones leading into them, and occurring as often as the nature of the subsoil may require—that a bed of lime concrete six inches in thickness, be laid all over the breadth of the road, and that this bed be afterwards covered with six inches of the best flint or pit gravel that can be procured, in two courses of three inches at a time; or with what in my opinion would be a much more lasting and serviceable material, four inches of broken granite stone and I am convinced that a road so constructed, however bad the under stratum may be, will prove one of the hardest, most durable, and at the same time one of the cheapest roads ever formed in the neighbourhood of London."

Of late years concrete has been occasionally employed as a foundation for the street pavements of London, and in some few instances, road surveyors of more than ordinary intelligence, have introduced it into their practice with very great success. All those who have tried it for keeping down the subsoil of the London clay, have been highly gratified with its success, wherever the proper precautions have been taken to prevent traffic until the concrete has completely set. We have heard of one instance where a concrete foundation was laid down for a road near London, and a few inches of broken stone being placed on it, carriages were immediately allowed to pass over it. The wheels of these vehicles were actually in contact with the raw unhardened concrete, and it is scarcely to be wondered at that it wore into holes and became almost impassable In this case the concrete was pronounced a failure, but it is scarcely necessary to observe how unfair were such a trial and such a condemnation. We could mention

[1] The Practice of making and repairing roads London Weale, 1838.

several other instances where considerable lengths of road, passing over the very worst descriptions of subsoil, have been successfully treated with a concrete foundation, which has ever since kept the clay from rising, and served more than any other contrivance could have done to keep the road in a sound and perfect condition. At the same time it is deplorable to witness the miserable and barbarous expedients which are resorted to, even at the present day, to form a foundation for the roads in the neighbourhood of London. It is generally known that the tough blue clay of the London basin, in common with the yellow plastic clays, on which the former rests, is one of the worst possible subsoils over which a road has ever to be formed, in consequence of its tendency to work up amongst the metalling. When the clay has thus become mixed with the metalling—whether consisting of gravel or broken stones—the most favourable condition for grinding down the crust of the road is at once realized, because the stones are separated from each other by a soft yielding matter, so easily squeezable and easily set in motion, that every pressure upon the road necessarily unsettles more or less the stability of part of the crust. The constant grinding of the stones against each other of course effects a destruction much more rapid than where the stones contain no more matter mixed up with them than just what is sufficient to fill up their interstices, and where this filling up matter is hard and firm instead of being soft and yielding, like the clay which has been spoken of. Few of the surveyors round London are ignorant of this troublesome property of clay, and they have in consequence commonly adopted some means which they have considered suitable for keeping the clay in its proper position beneath the metalling. For this purpose they have resorted at different times and different places to some one or other of the following expedients—large flat stones, broken bricks, bushes, or tin chippings. All these have been tried with various degrees of success, but with the exception of the broken bricks they are all either highly objectionable or perfectly useless. The flat stones become unevenly bedded in the clay, prevent the metalling from setting and binding, and cause the road to wear in a very irregular manner. The bushes are worse than useless, for they cause the road to be spongy and elastic while they continue to retain the least vestige of vegetable life, and when they decay and rot, the clay becomes kneaded and worked into them with the greatest facility. The tin chippings are of course well calculated, by the sharpness and hardness of their edges, for working and cutting into the clay, so that they actually do harm, and increase the evil they are designed to prevent. Of the several expedients, therefore, which have been mentioned, the broken bricks alone are entitled to any favourable attention. This substance being of a dry absorbent nature will in some degree correct the unctuous and slippery nature of the clay, tend to keep it at rest, and prevent it from working up so rapidly. It is evident, however, that this effect of broken bricks will be only temporary, for they cannot resist the repeated saturation of the clay, which must at length cause the latter to rise up through any thickness of broken bricks which may have been laid on. There are probably some of our readers who may be sceptical as to the employment of such a substance as bushes for the foundation of roads at the present day, and in the immediate neighbourhood of the metropolis. Such barbarous expedients, however, are by no means rare, and as an instance, we may mention the well known cemeteries on the south side of London at Norwood and Nunhead Hill. The approaches to these cemeteries and the paths made through them, have been executed according to the most approved system of bushing, as it is called, that is to say, upon a foundation composed of bushes covered over with a huge depth of clean sharp angular flints, without one particle of binding matter to unite them together. We need not say how much cheaper and more effectual it would have been to lay a concrete foundation, which might have been done for 1[illegible] per square yard, and to cover it over with six inches of metalling about half the thickness which is laid on at present. When a concrete foundation has been once formed for a road, the subsoil is effectually cut off and for ever prevented from rising. Therefore it is of little consequence whether the top covering be rather clayey in its character, or whether it contain only just sufficient clayey admixture to make it bind well together. In the worst case, that is, where it contains too much clay, the latter will soon work through the stones up to the surface, and during wet weather may be scraped off in the shape of mud. Where the concrete, however, is not interposed between the subsoil and the metalling, all the labour that can be bestowed in selecting good materials and in reducing them to a clean state, is absolutely thrown away, for it will all be entirely counteracted by the rising of the subsoil, which it must be remembered is quite inexhaustible, and will continue to rise through successive layers of gravel or broken stone, however thick they may be. Even in the best macadamized roads in London there is more mischief done by the working up of the clay, and by the consequent grinding of the stones together than by any other cause. The grinding action on a soft subsoil, is at least double what it would be on a hard foundation of concrete.

Materials proper for making Concrete.

There is no part of the country which is destitute of materials fit for this purpose. Amongst them may be mentioned any kind of pit, river, or sea side gravel, any kind of granite, sandstone, or limestone, broken bricks, fragments of pottery, oyster shells, and in fact every description of hard mineral substance. Should none of these be easily procurable, a very good substance for concrete may be made by burning clay in open heaps with any description of refuse coal. Clay burnt in this manner costs about 2s. 6*d*. to 3s. per cubic yard, measured in the heap when burnt, and will be found a very good substitute for stone, when the latter cannot be procured for making concrete.

Sand is an important ingredient which should never be neglected, but there are many substances which will answer equally well for mixing with the lime in concrete. Where sand, properly so called, is made use of, it should be clean, sharp, and not too fine, should feel gritty when rubbed on the palm of the hand, and should not soil the fingers, otherwise we may be sure it contains clay or loam, or some other substance which will injure the concrete. Amongst the substitutes for common sand may be mentioned the scales of iron, pounded iron ore after roasting, brick or tile dust, road drift, or pounded cinders. Any kind of clean sand may be used, whether from the sea shore, from pits, or from the beds of rivers. The Thames ballast, as commonly used for concrete in London, contains about the proper proportion of sand, namely, about one of sand to three or four of stones, conceiving all that to be sand which will pass through a sieve with wires one-eighth of an inch apart.

The varieties of lime, or what is the same thing, of the limestones which yield a lime proper for concrete or mortar, are so well known in this country, as not to require enumeration.

There is scarcely a locality in England where lime of some kind or other cannot be procured at the distance of a few miles, and although these limes are widely different in their quality, some being much purer and weaker than others, it may be taken as a general rule that the same quantity of sand which it would be proper to mix with the lime for making good mortar, will be just that same quantity which should be used with the same lime in making concrete. Thus the common white chalk lime, which if properly burnt—as it seldom is—will take 3 or 3½ sand, may be used with the same proportion in concrete, while the grey chalk lime should not be used with more than 2 or 2½ sand. The common chalk lime should never be used for concrete where it is subject to water or even to moisture in the ground, but the grey chalk lime may be used with perfect confidence in any situation, however damp. Specifications for concrete should always direct that the lime is to be ground into powder, otherwise it will not go nearly so far in the concrete, as innumerable small fragments will remain unslacked. This is of the highest importance, and should never be neglected, because no care, however great, bestowed upon the slacking, will so effectually bring out the virtue of the lime as when it is slacked in the state of powder.

The proportions which we would recommend for concrete in the neighbourhood of London, are the following:—

1 part by measure of pounded quick lime, burnt from the lower or grey chalk of Dorking, Merstham, or Halling.

2 to 2½ parts by measure of clean sharp sand, road drift, or other suitable material, as already described.

6 to 8 parts by measure of gravel or broken stones, &c., none larger than 2½ inches in its largest dimension.

Where the river gravel is used, and where it contains a sufficient quantity of sand, it may be mixed with lime in the proportion of one part of lime to 8 or 10 of gravel.

The best way to make the concrete for the foundation of a road, is to spread a stratum of gravel mixed with its proper proportion of sand to the depth of about six inches. This stratum should be formed across the road for the width of about four feet, and a covering of ground lime spread evenly over it about two-thirds of an inch in thickness. Three or four men should then turn the stratum of gravel and lime several times over, piling into heaps and again spreading it so as thoroughly to diffuse the lime. Lastly, it should be formed into a ridge about two feet high, and the water added only in sufficient quantity to mix with it by degrees, so as to form a thick stiff paste, in which every particle is just moist. In this state it should be spread and smoothed to the required depth, which for roads in the neighbourhood of London should be not less than six inches.

Underpinning Walls.

Concrete has been employed with great success by G. L. Taylor, Esq., Architect to the Admiralty, for underpinning walls of considerable extent. At Chatham the walls of a storehouse 540 feet in length were underpinned with concrete in about four months. The walls of this building had been founded about 10 years before on timber sleepers and planking, which had since decayed. It was necessary to excavate on each side of the walls to depth of from 16 to 26 feet to take out the decayed timbers, which varied from 2 to 6 feet in height, and were 6 or 7 feet wide. The concrete was put in in a liquid mass to within a foot of the bottom of the old walls, at this level a large slate was bedded on the concrete, and the remaining foot was *pressed* in by an iron frame with two strong screws on each side of the wall. The concrete was placed in lengths of four feet, and the next day the weight of the superincumbent wall, 50 feet high and 5 feet thick, was allowed to come upon it, and no subsidence has ever been observed. In another building at Chatham which had settled about three inches, Mr. Taylor raised the part affected to its proper level, by forcing concrete under it in a similar manner.

Ranger's Concrete Stone.

Notwithstanding the failure of Ranger's patent cement stone when injudiciously used, it is said to have been successfully employed on several occasions. The Architect to the Admiralty, G. L. Taylor, Esq., has used it for building a school at Lee, on the model of the Propylæa at Athens.

In the concrete dock which was built at Chatham, Ranger's stone was used in the form of blocks for the bottom, but the sides were formed of concrete laid in mass and lined with granite. The expense of this dock is said to have been barely one-tenth of the amount which a dock built wholly of masonry would have cost.

The patent stone has also been partially employed at Woolwich in a river wall at the east end of the dockyard. This wall is 270 feet in length, 26 feet high, 7 feet broad at bottom, and four feet at top. The work was at first commenced on the plan of the concrete wall at Brighton, namely, by filling the concrete in mass behind a fence of boards placed in front of the face. Latterly, however, the face of the wall was formed of concrete blocks cast in boxes, with the massive concrete filled in behind as a backing.

Use of Beton by the French.

When beton was first introduced into France, it was made up in heaps and allowed to set. The heaps were then broken up, and the broken lumps of beton or concrete thrown into the foundation which they were intended to form. The following translation from Belidor explains the method in which the beton was prepared for the works of the Dock at Toulon.

"Having fixed upon a spot where the ground is firm and solid, take 12 parts of puzzolana and 6 parts of sharp sand free from earthy particles, having mixed these together, form them into a circular border about 6 feet in diameter. Then fill the interior with 9 parts of well burnt pounded quick lime, which is then to be quenched by adding water in small quantities. For maritime works sea water is to be used, and the lime is to be turned over from time to time to facilitate the process of quenching. When the lime has been thus reduced to a paste, the border of sand and puzzolana is to be incorporated with it. The whole being well mixed, throw into it 13 parts of broken stone or stone chippings and 3 parts of broken iron cinder or scoriæ. When this latter cannot be obtained, 16 parts of broken stone may be employed, or 16 parts of pebbles may be used, provided they do not exceed the size of a hen's egg. The whole composition must then be turned over and mixed together with shovels for about an hour, until every part is thoroughly incorporated, and then the mass is to be made up into small heaps. These heaps must remain untouched till they acquire sufficient consistency to render a pickaxe necessary to break them up. The time occupied in acquiring this consistency will be 24 hours in the summer in warm countries, and in winter time about three or four days. The heaps should be covered to protect them from rain."

Speaking of beton formed in this way, a writer in the French *Encyclopædie Méthodique*, states that by way of experiment, a box containing 27 feet cube was filled with it and plunged into the sea, where it remained for two months. When taken up the cohesion of the heap was so great, that it was more difficult to break up than a block of the best stone.

ON WARMING AND VENTILATION.

The objects proposed to be accomplished by the different methods of warming apartments, namely, those of producing an economical heat, and at the same time of ventilating them, by causing a continual circulation of air, in that state which is most conducive to health and comfort, are certainly of great importance and difficulty.

In all the different modes by which these effects are usually more or less produced, there are involved two very distinct principles, which produce corresponding changes in the condition of the air contained in the rooms where they are brought into operation. One of these principles may be termed that of diffusing heat by radiation from fires and heated surfaces, and the other that of heating air and making the diffusion of it a vehicle for conveying heat to the places where it may be required. The alterations produced in air by heat, so as to render it more or less salubrious, according as one or other of these principles is brought into operation in the different modes adopted to warm and ventilate rooms, will now form the subject of consideration.

When rooms are warmed by radiated heat as from ordinary fires, the temperature of the air which they contain is not so greatly raised as when heated air is made the vehicle to convey and diffuse heat. By radiation heat is diffused independently of air. Air, like all other gases, is eminently a bad conductor of heat, and hence it is that any particle of air, being heated by contact with hot bodies, does not appear to communicate any portion of the heat so acquired to the contiguous particles, but its repulsive energies becoming developed, it pushes the adjoining particles to a greater distance, and thus increasing their volume and rendering their specific gravity less, they necessarily rise and make room for others to follow the same course. Nor is the mass of air in a room warmed by radiated heat being transmitted through it, but this heat meeting with more solid forms of matter, as with walls, &c., is absorbed by them. These walls and other bodies thus becoming heated, radiate in all directions, heating the air in contact with them, and this heated air then translates itself as when heated in contact with fire. There is thus a continual but gradual warming and circulation of air from all heated surfaces.

Now if we suppose a room of the following dimensions, 30×20×20 feet, its cubic contents will be 12,000 feet. Let us suppose 1 foot to be the sectional area of the flue by which the products of combustion and draft escape to the atmosphere, say with a velocity of 10 feet per second. There would then be transmitted through such a flue in 10 hours, 360,000 cubic feet of air, which would renew the air of the room 30 times in that period, or 3 times in each hour during the day, an extent of ventilation sufficient for the most crowded apartment.

It follows, from the non-conducting and non-absorbing power of air in relation to heat, and from its being so frequently renewed, that the temperature of air contained in rooms heated by ordinary fires can never be great, but that the warmth which is felt in them is in a great degree the effect of radiation, and not that of heated air. This process of warming and ventilation is exactly that adopted in the general habitation of man and all organized beings—a strong *a priori* proof that their physical organization is adapted to such conditions of the air as this process induces, and to no other. That such conditions do obtain in the physical atmosphere, is evident. If air absorbed the heat of the sun it could not reach the earth, but would produce a temperature in the upper part of the atmosphere, that might precipitate showers of rain little short of boiling heat, and cause tempests of the most violent character, owing to the great extremes of temperature to which it would be liable, for under such circumstances the temperature of all bodies must be as the quantity of heat they intercept.

In all methods of warming rooms by heated air, as by passing it through hot pipes, or by means of cylinders containing coils of pipe, heated by the circulation of hot water, the mode of diffusing heat is the same. The air is made hot and poured into the rooms in a continued stream, supplying heat and ventilation. The important difference between this and radiation is, that the air is first made hot and gradually communicates its heat to some parts of the room. Air so circumstanced, must be hotter than any object to which it imparts heat, while the reverse is the case where radiation is employed. As heated air is lighter than cold, it is quite evident it will chiefly occupy the upper part of rooms so heated, especially when it is diffused from one aperture, and that at some distance from the floor. By testing with a thermometer, it is found that rooms heated by hot air are increased in temperature about two degrees per foot from the floor upwards, so that a person of ordinary dimensions might be said to have his head in a summer and his feet in an autumn tempera-

ture, a condition which justly and generally considered the reverse is of what it should be.

But by far the most important and injurious are the effects which heat produces on the air with respect to the quantity of aqueous vapour which it contains, for on this depends its power to absorb more, or to precipitate that which it holds. According to Dr. Dalton, the amount of aqueous vapour which the atmosphere can contain at any given temperature in a state of invisible steam or vapour, is a fixed and definite quantity for that particular temperature. If that temperature be lowered, the point of saturation is also reduced, and the particles of vapour losing a portion of their repulsive power, coalesce and form sensible humidity or dew. If, on the contrary, the temperature of air be raised above any given point of saturation, the constituted tendency of water to become vapour is permitted to take effect, with an energy proportional to the increase of heat: hence the desiccation of all surfaces exposed to its influence proceeds at a rapid rate, when they are immersed in air raised much above the temperature of the atmosphere. At all times and places the atmosphere is generally at or near the point of saturation with aqueous vapour. Taking two rather extreme cases, Glasgow in Scotland with a humid state of air, and Funchal in the island of Madeira, the mean temperature of which are 47.75 and 66.3, the mean dew points are 45 and 61, indicating forces of elastic vapour of 0.3 and 0.538 inches of mercury, all respectively. We thus see in a moist and also in a dry climate of great salubrity the near approach of the air to saturation with aqueous vapour, so that its general tendency to absorb water is not great.

It will probably be thought by some, that the general state of the atmosphere in the consideration of this subject, is inapplicable: but it should be recollected that the same wisdom which contrived the organization of all living beings made also a state of atmosphere adapted to that organization.

Now, suppose air in the cold of winter at a temperature of 20° raised to that of 70°, by passing over coils of heated iron, or in any other way, it must absorb with avidity, every particle of moisture thinly spread over large surfaces. Having just been transferred from an atmosphere of 20°, it could not be much more than saturated for that temperature, and consequently the heat has produced a condition of air which is nowhere to be found in nature, unless, indeed, we except the sirocco of the arid sands in Western Africa.

Persons who pass large portions of their time in apartments heated and ventilated in this way, feel extreme dryness of the skin, fulness and throbbing about the head, soreness of the eyes, a dry and kind of asthmatic condition of the mucous surfaces, general excitement, and in some degree prostration of strength.

Medical men have frequently employed hot air baths for their stimulating effects: but that which generally exercises a beneficial power in extraordinary states, as in disease, must surely have a deleterious influence when permanently in operation, even in a less degree than that commonly employed for medical purposes, and especially in states of bad health of an opposite character to those for which it is employed as a remedial agent, as for instance, when any tendency to apoplexy exists.

It has been proposed to remedy the dry state of heated air, by evaporating water, conveying steam with the heated air &c., but all such means are too complicated for the intended purpose, and incapable of adaptation to the circumstances of the case. For during the time when the apparatus is not in use, if the air had been near a state of saturation with aqueous vapour during the day, a large precipitation of dew would take place on cooling, and also during the day, owing to considerable changes of temperature. From these facts and circumstances it is evident that no ordinary fire fulfils all the principal objects of warming and ventilation, better than any of the unnatural modes which science, ingenuity, necessity, or desire for novelty has yet given birth to.

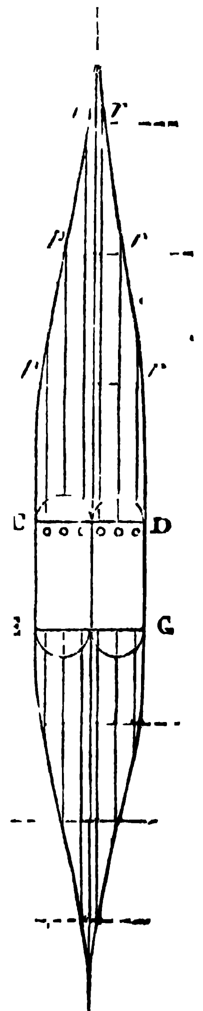
W. G.

THE FORMS OF SHIPS.

The great importance of naval architecture induces us to return to the report of experiments conducted by a committee of the British Association for the Advancement of Science, which was read at their last meeting at Cork. The account copied into the last number of our *Journal*, from the *Athenæum*, was chiefly limited to the notice of the experiments themselves, and merely adverted casually to the deductions founded upon them, without describing the form of least resistance which the committee recommend as the result of their five years' labours. We have since been supplied with a further account of Mr. Scott Russell's exposition, and as the experiments have been more numerous, and have been conducted on a larger scale than any previously made on the subject, we think it desirable, in the absence of the voluminous report of the committee and drawings, which may not be published for years, to state at least some of the results of these long-continued and costly experiments.

In Mr Scott Russell's exposition of the labours of himself and Professor Robison, after mentioning minutely the mode in which they had conducted their experiments, and their results, he proceeded to describe the form of construction which they had determined to be the best, not only as offering the least resistance to motion through smooth water, but also as best adapted for rough seas. It is to be regretted, however, that in this, the most important part of his exposition, Mr. Russell was less explicit and not so minute as in describing the preliminary experiments. He stated facts, but did not explain the principles by which they were regulated, therefore it is difficult from one isolated form of construction, which was all he exhibited, to determine how far it is adapted to vessels of other sizes. He observed, that the great point which, in the first instance, was endeavoured to be gained was to get rid of the wave at the bow, which has the same effect in retarding a vessel as if it were immersed so much deeper in water. It was found that this object might be attained by lengthening the ship, and that whenever speed was required, there must be an absolute length without regard to breadth.

Mr Russell having stated that each velocity has a corresponding form and dimension peculiar to that velocity, he exhibited the form of the light-water line of a steam-vessel intended to be propelled with a velocity of 17 miles an hour, and explained the mode of constructing it. Suppose the breadth, C D, of the vessel to be 25 feet, there must be set off forward from the greatest midship-section 120 feet, and for the after-part, 85 feet. To make room for the engines, there is no objection to putting in a piece in the middle of the vessel, called the middle-body, of equal width to the greatest midship section. On half the breadth of the vessel, fore and aft, describe the semicircles C, D, F, G. Divide the fore part, *o* A, into a given number of equal parts, and divide the semicircles also into the same number of parts, in the accompanying diagram, we have divided them into not more than four, for greater distinctness. Then draw lines parallel to the keel, A B, from the divisions *o*, *o*, *o*, of the semicircles to the corresponding divisions *p*, *p*, *p*, and *r*, *r*, *r*, of the keel, and the points where the lines intersect show the form of water-line required. The form thus attained, it will be observed, is very sharp both fore and aft, though the after part, or run, being shorter, is necessarily more full than the entrance of the vessel. This form is much opposed to the ordinary practice, inasmuch as the line is hollowed out or partly concave, instead of being of the convex form, or full bow, which old ship-builders so much admire.



Having thus described the form of the light-water line, Mr Russell promised to give the view he entertained of the principle on which the superiority of its construction depended, in this particular, however, he failed to make himself very clearly understood. He first alluded to the notions entertained of the manner in which the water is displaced by the motion of a vessel. It is commonly supposed, by ship-builders, that the water passes round the vessel, some imagine that the fluid is rolled under it, whilst, according to the French philosophers, the impact of water obeys the same laws as the impact of solid bodies, and the water is reflected from the bow at an angle equal to the angle of incidence. From the latter assumption they deduced that a round full bow is best adapted to meet with least resistance. It had been proved, however, in the course of these experiments, that the particles of water displaced by the bow of a vessel move into new places, that peculiar motions are given to them, and that they never return to their former positions. The motion of displacement, also,

was found to be not confined to the vicinity of the vessel, but to have an extensive effect in a region anterior to the bow, and extending to a considerable distance on each side; and some time before the bow approaches a particle of water, the fluid has commenced moving. Viewing the sea as composed of innumerable vertical columns of water, the effect of the approach of a vessel is to produce greater pressure on one side of such columns than on the other, and water being, practically speaking, incompressible, the particles pressed against can move only in a vertical direction, and thus a heaping up of fluid is produced before the bow of the vessel, sometimes ranging as far as half its length. The next object the committee had in view was to examine the direction of the motion of the particles of water displaced by a vessel. It was found that when the form was that of least resistance, the motions of the particles of water were in semicircles, and that they deviated from that curve when the form departed from that of least resistance. It was also determined, that the replacement of the water as a vessel moves forward, takes place entirely from below. The result, therefore, to be attained, as appeared from these experiments, was to ascertain the form of the solid of least resistance, which would communicate these motions to the particles of water. In experiments on the forms of waves, conducted also at the expense of the British Association, it had been ascertained that the motion of water itself is that which the committee had endeavoured to give to the water when ships pass through it. Thus it happened, that the form best adapted for least resistance in smooth water, being itself the form of the waves of the sea, the vessel of that ship moved through the sea with the least motion and the least resistance. The consequence was, that in the course of these experiments it was found that a vessel built in the form of least resistance in smooth water, instead of being, as was formerly supposed, likely to be wet and uneasy in a rough sea, in fact passed through the waves without doing more than modifying their motion, and that in proportion as ships approached to the form of least resistance, they were dry, easy, and good steering boats. The concluding experiments were made on ships of 2000 tons, differently formed, and the same law which was found to prevail in smaller vessels was also followed in the large ships and in the roughest seas.

We have endeavoured, on the foregoing report, to give an intelligible account of the deductions from the experiments on the form of ships as could be collected from Mr Russell's exposition. It is evident, however, that there are many points of importance not sufficiently elucidated, and though the principle on which the advantages claimed for the wave form is attempted to be established as regards easiness of motion in a rough sea, the reason why that form is the one of least resistance in smooth water, is by no means clear.

It is a very difficult, and perhaps an impossible task to extract the pith from a voluminous mass of papers, calculations and drawings adapted to differing circumstances, so as to present, in a comparatively small compass, a satisfactory view of the whole; nevertheless, we wish to arrive at some fixed laws, and the principles on which they are founded. It appears that in all the experiments the object aimed at was to ascertain the form of least resistance in *cutting through* the water, and that no attention was bestowed on the form best adapted to cause the vessel to glide over the head-wave. The experiments, however, which were made a few years since on the Scotch canals with passenger boats, in which we believe Mr. Russell himself took part, show that the head-wave may be prevented by the boat being raised in the water by the oblique impact of its bow with the fluid.

BRITISH MUSEUM.

SIR—If but small, it is some satisfaction to find that within the few last weeks, the subject of the British Museum has made a little stir, and whatever journals have touched upon it at all, have been pretty unanimous as to two points—first, that the building—at least the façade, *ought* to be made a noble piece of architecture, secondly, that it would be futile to look for any such production from Sir Robert Smirke.

Such, too, is the opinion which has been expressed by the *Spectator*, in an article headed "Completion of the British Museum," wherein are quoted, as from a correspondent, "some severe, yet deserved strictures on the architect," in which the journalist himself appears fully to acquiesce. Yet after so far inculpating Sir Robert's professional character, and quoting a long list of his architectural failures, the *Spectator* is still of opinion that we ought now to abide by the bargain we made with him—or rather, which has been made with him for us.

"Any glaring defect," it says, "in the front, ought to be amended, as far as it may be, by Sir Robert Smirke; but we question if it would be right and just to take the work out of his hands, and intrust the completion to another architect, even if the Trustees of the Museum would do so—which is not very likely."

Certainly not, for the Trustees—who have shown themselves not fit to be at all trusted with their building, as far as architectural taste is concerned—appear to care nothing about the matter. They are satisfied themselves, and whether the public is or will be satisfied, is to them perfectly indifferent.

The *Spectator*, too, thinks, that as things have already gone so far, we ought now to be reconciled to what can't be helped, stipulating only that "ANY GLARING DEFECT SHOULD BE AMENDED." Now, in the first place, Sir Robert Smirke is not at all the man to commit "Glaring defects," much less is there any danger of his violating the decencies of common place, he knows what the mere good-breeding of his art requires, too well, to shock us by gross improprieties—he has "*larnt manners.*"

In the next place, it is truly astonishing to find a writer professing to be a critic in art, well content, if instead of a façade worthy to rank high as a finished work of art, we do but get one free from "glaring defects."

But just now, I said that Sir Robert was not the man to commit glaring defects, yet must correct the observation, for one most glaring, pervading defect stamps all his buildings: they are all alike sullen and soul-less—dull and unimaginative—the very best of them of that kind whose highest praise and damnation are condensed into the epithet "Respectable"!

His designs are of a sort that do not admit of being corrected, otherwise than by being remodelled and recast, and having some spirit—some ideas, infused into them.

The *Spectator* concludes with saying, "let us hope that the façade will be 'respectable,'" and in this there may possibly be a sneer of contemptuous irony, for hardly is it possible to conceive that any one should seriously mean to say we ought to consider ourselves well off if, instead of a magnificent edifice capable of challenging any other work of its kind in any part of Europe, we do but get what will barely pass muster as "respectable."

For Sir Robert Smirke himself I have no pity, he deserves none he merits all the obloquy and ignominy he is about to draw down on his devoted head. Fortune he has made—fame he has missed, why then does he not now distinguish himself in the only way left for him. Let him act the Roman part—let him claim if not the applause of his country as an artist, its gratitude as a patriot willingly immolating himself for the public weal. Let him heroically resign the British Museum to some one worthier of the task, and then, be all his sins forgiven.

C—— S.

OBSERVATIONS ON ARCHITECTS AND ARCHITECTURE.

By HENRY FULTON, M.D.

No 2.

The Houses of Parliament, the Exchange, and the Conservative Club in St. James's Street, are in progress, and the façade of the British Museum is spoken of. I trust Mr Barry in the first will avoid an error in his otherwise much to be admired school of King Edward at Birmingham, and give us windows of a bolder and broader character.

There are only three orders of columnar architecture worthy of imitation, viz, the Grecian Doric and Ionic, and the Corinthian. I most sincerely wish that the knowledge of all others was lost. The indignation of a man of taste should boil, at seeing the ornaments and emblems of these beautiful orders prostituted, by being coupled with the vile trash which is given to the public as their imitations: the triglyph indicates symmetry and stability in the Doric compositions of the Greeks, but in the lower order of the Exchange, weakness and an overburdened architrave. Could not Mr. Tite remove this index of overweight and undue proportion, and call his order Tuscan, a name more to be honoured than any other form of debased Doric.

At least the Conservative Club in St. James's Street aims at having one advantage over the Reform in Pall Mall, namely, the representation of a collection of the boxes used by Her Majesty's ministers, (for such is the shape of the quoins,) intending by this, perhaps, to show the determination of the Conservatives to retain their places as such

be not the indication, we must seek the reason, for the rustic work, in a similarity of taste with New Zealanders and other polite nations of the Pacific, who tattoo their faces, and consider scars and scratches as so many lines of beauty: for my part, as I prefer the face human without the scars, however geometrical, so do I the face mural, without the rustic lines and gashes. A writer in this *Journal*, with much wit and truth says, that lawyers and architects are the only men who are the slaves of precedent. I wish that some high authority, in addition to experience, could be brought forward to show that as the savages in vain attempt to hide the nakedness of their bodies by tattooing, so do some architects, by treating their buildings in the same way, in vain attempt to hide the nakedness and meanness of their designs.

Much dissatisfaction has very reasonably been expressed at the secrecy observed with regard to the expected façade of the Museum. Sir Robert Smirke, no doubt, says, "From the character of my other works, you may safely rely on the fitness of the forthcoming façade." The delineator of Magna Græcia said the same thing under similar circumstances with respect to the National Gallery: for my part, my faith in Sir Robert is not so strong, the only work we have of his (I believe) in Ireland, is the Wellington testimonial, and a decided failure it is. Of all the works of a monumental character which the ancients have bequeathed to us in possession, the pyramids are the best, and the obelisks the most pleasing: the Wellington testimonial partakes of the character of both, but approaches more nearly to the deformity of the first, than the beauty of proportion to be observed in the latter: the height of the shaft is only about 5½ diameters, instead of being 9 or 10 as in the obelisks.

Without being possessed of any private information on the subject, we can easily say what the façade will be—a portico of six columns, with plenty of triglyphs on the frieze, in compliment to the Lapithæ and Centaurs of the Elgin marbles, and to show the possibility of having an architrave which shall appear to be overburthened and yet not give way: to borrow a phrase used in the description of civic feasts, like the tables loaded with viands it shall appear to groan! Then we shall have a pseudo portico at each flank by way of wings, with sham pediments also, stolen from the gable end of some Greek temple, not to surmount another gable, but a long colonnade like the river front of Somerset House, requiring three, and spaces between. On these misplaced pediments we shall have various apothecary-looking works, copied either from those of Somerset House or from the antique models to be found in the Museum. These three porticos will be advanced a little in front, for the purpose of showing that they do not belong of necessity to the building, but on the contrary, may safely be removed for any other purpose, *ejus sit*. No, Sir Robert avoid these peculiarities, and give us a front something like that of the Berlin Museum, and do not be afraid of the spectator's eye requiring to be relieved by broken lines and cornices, nor seek to give your design a military character, by the introduction of cocked-hat pediments over your doors and windows.

I formerly made some observations on these ornaments,(*) to which a critic under the signature of G. W. R., in the fifth volume of this *Journal*, page 128, says in their defence that, if these gable tops be unsuited in Palladian architecture, shall we not be obliged to condemn quite as much the beautiful pedimented canopies over the windows of York cathedral. This does not appear to be a *quid pro quo*, any more than that it should be argued that because pointed arches, flying buttresses, pinnacles and finials are introduced into such edifices with complete success, it would be advantageous to mix them up in a Grecian composition. But although G. W. R. truly says I was unable to discover the use of these window tops, yet he might have also seen that, with great disinterestedness, I gave Palladio all the merit of the discovery, and that I merely suggested that one figure would answer as well as Palladio's two. If any architect who admires these window pediments so much, would have the kindness to exhibit himself undressed, and Bacchus-like, astride one of those at the Reform Club House during certain hours of the day, admiring spectators might at a glance decide on the advantage of my suggestions, as compared with the practice of Palladio, the effect of whose plan might be shown by two other architects on an adjoining window.

I have to complain that the same critic misrepresents me, (and critics do sometimes misrepresent,) by making it appear that I derived the pointed style directly from the Roman. Now I asserted no such thing, but referred to the ruins at Spalatro for the origin of the semi-circular arch on slender columns, supported by consoles, (see Vol. V., page 7 of this *Journal*.) and as it is generally admitted that the pointed arch was formed, and in point of fact can be formed, by the interlacing of the semicircular arch, it is not going too far to say that even the beautiful pointed style may owe its origin *indirectly* to the debased Diocletian.

* See Palladio's works, book II, chap. 3rd, plates iv, vi, and viii.

I cannot see the force of G. W. R.'s objection to my saying that the graduated basement of a Doric temple might be considered as the base of the columns: the observations made by me on that head were with reference to a portico, which has no basement raised above the level of the street, (see page 80.) But if G. W. R. had read the paragraph preceding the one he censures, he would not have raised an objection.

To return to the Museum—if pure Grecian architecture must abide its time, and that we are not yet fit to appreciate its merits, let Sir R. Smirke consult the magnificent works on Egyptian antiquities, published by the Imperial Government of France, and give us an Egyptian front. No building ever was, or perhaps ever will be, erected in London, more suitable for that style than the Museum. But I speak of the court yard as it was when I last saw it three years ago.

In College Green, one of the best situations in Dublin, there is in course of erection a gin palace—I beg pardon, it is intended for a bank, but the fitness of the thing might well excuse the mistake, and indeed it is quite impossible to look at it without being struck with the resemblance. I had intended to give a drawing of it, but as there is no lack of palaces in London, it would be a waste of space in this valuable *Journal*; besides, the building although of cut stone, is of so slight a nature, that it does not appear intended to remain very long. The architect of it, (if such there be,) with a taste which does him credit, and with a spirit of chivalry worthy an architect belonging to a free and enlightened people, viewing the over-burthened state of columns in the hands of modern architects, has in the present instance relieved his from any such irksome tasks, and not obliged them to support anything, for the perpendicular line of the edifice falls behind them; to be sure there is a kind of cornice on a level with the commencement of the first floor, but what of that, the whole is in "a free unhoused condition" and by this expedient he has been enabled to make the columns more slender and graceful than any example with which I am acquainted. And after all, the idea of making the edifice resemble a palace was not a bad one, for with little or no alteration, it can at any time be turned into one, should it no longer be required for a bank, or should its neighbours of Trinity College, the Bank of Ireland, or the Royal Irish Academy, require a gin palace in their vicinity, *sic transit gloria mundi*, that is, "to what base uses may we return, Horatio."

THE PALACE OF WESTMINSTER.

SIR—Reports both official and popular relative to the Palace of Westminster are all highly favourable and satisfactory, still there is one point, and that of no small importance, in regard to which nothing has yet transpired, nor have any questions been put. Far as the structure is now advanced in appearance, it is appearance chiefly along the east side of the plan: considering, therefore, the immense mass of inner buildings and courts there will be behind, and that all the present buildings on the west side will have to be cleared away, a very great length of time must elapse, before the entire pile can be constructed in its main walls, roofs, &c.

If I mistake not, the Peers' House is to be finished within about two years from the present time, but surely that does not include decoration, supposing that fresco-painting is to form any portion of it. And even then, the accommodation for public business, so far afforded, will be very limited and imperfect, unless all the contiguous parts of the plan can be carried on at the same time. Should that not be possible, no small inconvenience is likely to be felt, both by their Lordships, and by the architect, who will have to exercise a good deal of management and contrivance for which there would be no occasion, were none of that part of the building required to be taken possession of, until it was thoroughly completed.*

The question—when is, or when can, the work of embellishment commence? is perhaps one which no one can yet answer, neither may any one be as yet prepared with a readier reply to that of—*Where* is it to commence? As fresco-painting will at first be somewhat of an experiment among us, surely the artists will not be allowed to try their "'prentice hands" on any of the principal rooms intended to be so decorated. It is most probable, therefore, that they will begin

* A similar sort of inconvenience is now experienced in the British Museum, where temporary passages and partitions are obliged to be erected while the workmen are employed on those parts of the building which have to be added or adapted to those already finished.

their operations in the corridors, yet if they are to be carried on there to the extent now contemplated, it must be either very rapidly or very slowly: either the whole work must there be executed with all dispatch possible when once begun, so that it may be got out of hand, or, it must proceed very gradually indeed, and perhaps only at intervals during a long series of years.

Our artists, I conceive, are likely to have ample time to prepare themselves for study, ere their services will be required for the Palace at Westminster, which may not be till some of them are grown grey-haired. As a last question—one which deserves to be well considered, will it be possible to grant the public that free access to the interior of the building, which it now seems to be taken for granted will be the case? The very plan shows that it is not at all adapted for the purpose of a public gallery of art, and that to convert it to such would be incompatible with the more important purpose for which the building is destined.

I remain,

Your obedient servant,

I. B.

THE BRITISH MUSEUM.

(With Plan of Façade.)

Whether or no any positive beneficial result ensue from public attention being kept alive as to the British Museum, the subject is one that is very far from being yet exhausted, and which ought not yet to be dropped. In fact, with the public generally it is but just beginning to make any sort of stir, and interest—at least curiosity, has been so far excited, that several inquiries have been made as to the possibility of obtaining a sight of the model which is deposited somewhere in the building itself. It was not very long ago rumoured that it was open to public inspection there, yet this turns out not to be the case, applicants being informed that the model cannot be seen without an express order from the architect himself—which is tantamount to a civil sort of peremptory refusal, since it compels individuals to solicit as a particular favour and indulgence what ought to be matter of public right, for if there be no general claim of that kind, the applying for the favour is no more than what might be done with equal propriety in any other case.

We were told that we might write to Sir Robert Smirke, but we were not at the same time assured that such application would be attended to, so thinking that it might after all, be very much like summoning spirits from the vasty deep, we declined making the attempt, as, we suppose, most others have done. The precaution adopted, is in itself a very politic one, for while it makes a show of a little liberality, and renders it impossible to say in strictness of truth, that the model is not allowed to be seen by any one, it effectually excludes those who are the likeliest to be able to judge of the design, and to express their opinion of it. It requires some sort of assurance to ask a man as a favour to be permitted to inspect a production of his, that you want to see for the express purpose of telling the public your opinion of it—be it ever so unfavourable. Accepted as the boon of courtesy, the permission itself becomes a bribe to criticism—a padlock upon its tongue: at any rate one does not feel at liberty to express one's opinion altogether so freely and independently as if he had paid his admission shilling at the door, or as where gratuitous admission is universal.

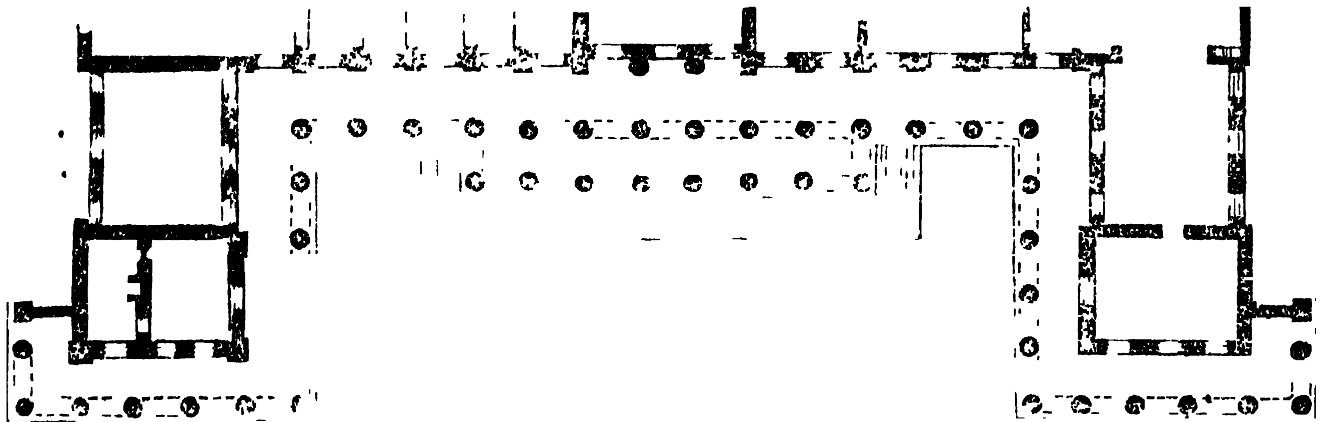
That the refusal of this last should still be persisted in is strange, yet by no means inexplicable, on the contrary, it suggests at once to the dullest apprehension, both of what kind, and how powerful the motives are which prevent compliance with what is but a reasonable demand on the part of the public,—more especially as it is impossible to allege in this case the slightest difficulty or inconvenience in granting facility of access, nothing in the world being easier than to remove the model from its "prison room," and place it in the hall of the Museum. In general, architects and artists rather rejoice than otherwise, when they find the public take particular interest in, and make inquiries as to the progress of the works they are employed upon. So far is it from being usual to show such excess of caution, silence, and reserve, as has all along been kept up in regard to the British Museum, that it is quite common for architects themselves to exhibit by publishing or allowing to be published, designs or views of buildings, while in progress, or perhaps only just begun. We could quote numerous instances of this: two may suffice—and those can be verified by our own readers, for we were enabled to give designs and descriptions of the Reform Club house, long before that structure was completed, and have in our last number laid before them an elevation of St. George's Hall, Liverpool, nor has its author had any cause to repent of the publicity which his design had previously obtained. Why then, should so much mystery be made of the design for the façade of the Museum? as if the public had positively no right to feel any curiosity about it, to take any interest in it, or make it in any way, any concern of theirs. Such extraordinary reserve shown in this instance by the architect, may pass with some for modesty—for the natural bashfulness, not of sixteen, but sixty. Far more likely does it proceed from pride, or likelier still from the conscious foreboding that to exhibit his model to public scrutiny would be to sign its death warrant.

Notwithstanding, however, the most jealous precautions, something has transpired, and enough to lift up a good part of the veil hanging over the front of the British Museum, for knowing its plan, we can give a very tolerable guess at its elevation, and might even undertake to draw it out, and exhibit it as the architect's own, for such is his mannerism—so unvaried and stereotype, so bare and poor are all his *[illegible]*, that they may be dispensed with, and we may pretty confidently rely on such particulars as can be gathered from a ground plan alone, knowing that of ornamental design and decoration, there will be nothing except what arises from the order itself, or rather from the columns, all the rest being bald and naked. Such being the case, there is, after all, very little necessity for demanding to see the design, since we may fairly be said to have been made fully acquainted with it already, the plan being published in a parliamentary report, so long back as five years ago, nor is it at all likely to have since undergone any alteration or correction or modification, for Sir Robert is not given to vacillation: he knows his own mind, abides by his first idea, instead of foolishly endeavouring to improve upon—perfection.

At all events, nothing has been said as to another design having been since substituted, as would undoubtedly have been done, were such really the case, in order to disabuse the public of a very great mistake. We may, accordingly, with that design or plan before us, and here exhibiting a reduced copy of it to our readers, which will enable them to follow us in our remarks, and spare ourselves a great deal of tedious explanation—proceed to criticize it.

It will at the first glance be seen that there will be a considerable degree of effect—and that of a kind we are unaccustomed to, produced by continuous columniation, breaking round the outline of the plan, and thereby displaying lines of columns at right angles to each other, consequently varied in their perspective appearance, and in regard to light and shade. We freely admit that so far we shall have something classical, even striking in character. Strange, indeed, would it be, if forty-two fluted Ionic columns, ranged continuously, but on different lines, did not produce a certain sort of grandeur, and we may venture to say that the *first-sight coup d'œil* cannot very well fail of being impressive. So far, therefore, all very well: yet in such a case, surely *so far* is very far indeed from being far enough, since it will be by no means sufficient if the façade be calculated merely to captivate the eye, on a first and cursory inspection of it: on the contrary, all the more likely is it, in consequence of the pretension and promise so made, to cause disappointment and dissatisfaction, after the feeling of mere curiosity has been gratified, and it is then discovered to be one of those things which have the peculiar merit of "looking best at a distance," a merit, by the bye, which is more common than we could wish to find it. It is neither every building, nor every person, that improves upon further acquaintance: of both there are not a few to whom we may apply the line of the epigram—

H[illegible] less [illegible] liked you had [illegible] seen you *twice*!"



So, too, in the case of the façade of the Museum, it proves on examination to be very far from fulfilling the promise made to the eye at first sight. the circumstance of there being windows at all must prove, if not fatal, a very serious drawback, where the most *starched* classicality is affected as far as the mere order is concerned. Such apertures must inevitably destroy one essential characteristic of a Grecian colonnade—breadth and repose. Hardly any skill can reconcile together the style represented by the columns, and that by the windowed wall behind them: at any rate *purity* of style is forfeited, and a mixed one substituted for the original, therefore it becomes indispensable to render that *mixed or compound* one, wherein the respective conflicting elements shall be brought into harmony—the whole into keeping. Having passed the Rubicon it is of no use to halt, for then to stand still is to have done nothing, so when an architect has not scrupled to violate the simplicity of Grecian architecture, by introducing windows, he must either convert them into features of positive beauty in themselves, or leave them to be reprobated as solecisms and blemishes. No excuse will it be for him to say that he has no sufficient authorities to guide him for windows of rich and ornate character in the Grecian style; since neither has he any authority for introducing windows at all, and if he can brave through authority as to the one, he surely need not scruple to do so as to the other—especially when by so doing he would have an opportunity of showing his taste and invention, and convincing us that his study of antique design had furnished him with resources not at every one's command.

We admit that we are here setting up a high standard of taste, and exact much more than is generally to be looked for, yet not at all more than the occasion both demands and admits of. Surely it is not at all unreasonable to expect that a Museum—a National Museum—one perhaps the first in the world in regard to the treasures it contains—should be also a splendid and perfect work of art, as a piece of architecture. Are we to be content with merely having something tolerable—decent—respectable—possibly good, and so forth? That humble degree of merit could be obtained much more cheaply—without such an array of columns, without so much pretension, the effect might perhaps be all the more tolerable in consequence. We have had quite enow samples of *tolerable* Grecian architecture before, and now, we fear are about to have one again, where it, to be no more than tolerable, will be actually insufferable and disgraceful.

That the plan will be exactly followed in regard to there being windows within the colonnades and portico, is now but too evident, for the main walls of the building forming the west pavilion or wing of the façade, are now raised—that is, in rough brickwork, to be afterwards *faced* with stone, just as an old building might be *refronted* with new material, and from them we perceive that there will be a single range of windows, on about the same level as in the quadrangle or inner court, and they will, no doubt, be nearly of the same character, with no more dressing than will just be sufficient to prevent our saying that they have absolutely none. In this respect, therefore, the colonnades of the Museum will be almost exactly such compositions as is that which forms the centre of the Custom House, with all the less excuse, because if Sir Robert could not foresee the effect before, that experiment ought to have convinced him that it would not do to be repeated in the Museum, more especially as the public will naturally look for greater refinement of taste and display of imagination than in a Custom House or a Post Office—even for some evidence of poetic inspiration; but we suspect that the architect of the Museum is better acquainted with per-centage than with the muses.

Were the number of the windows in the façade reduced to half,—the plan should have been so contrived that there should have been no necessity for any—corresponding with the *alternate* intercolumns; there would have been some degree of breadth and repose, whereas now they will cut up the background, and what is more, they will not correspond with the intervals between the columns, at least not on the sides or returns facing east and west, for there, instead of falling exactly in the axes of the intercolumns, there will be—according to the original plan, at least—no regularity in that respect, for in some instances the windows will be partially, and in two others, exactly behind columns! besides which, there will be some windows thrust quite into the inner angles of the plan. How such a very strange disregard to the most ordinary rules of symmetry should have arisen, it is easy enough to perceive, it being evident enough that being unable to hit upon any mode of keeping up symmetry of arrangement in his windows, both internally and externally, the architect has sacrificed exterior to interior appearance, thereby incurring, we think, the far greater evil of the two, since defects of that kind, if to be tolerated at all, might more easily be excused in such rooms as come into this part of the plan, since they will not be seen by the public, the former being for manuscripts, the others for the Trustees, than in the "grand and classic" façade, where such blemishes are likely to be noted by every one as most strange and sad architectural bungling. Surely Sir Robert Smirke could never have given a second thought to his own plan, or even he must have detected such very palpable "school-boy" mistakes. Or are we to suppose that detecting, he could not remove them?

Come we now to the central portico: here an advanced line of columns added to the general colonnade forms an octastyle which will, doubtless be crowned by a pediment; thus, besides some variety being imparted to the *elevation*, there will be some richness and a more than ordinary degree of perspective intricacy will attend the inner range of columns seen behind those in front, of which disposition of them we have as yet no example in any of our London porticos. Still it may be questioned if such arrangement of the columns is the very best suited for the occasion, because there is hardly sufficient space for so many columns in that direction within the portico, the latter being rendered thereby nearly as shallow as far as actual serviceableness is concerned, as the other colonnades. There will be no amplitude of space any where, the entire plan of the portico being

subdivided into so many lesser squares of uniform size; whereas, had the hinder part of the portico been made to recede within the building—either wholly or to the extent of the three or the five centre intercolumns—then the effect of passing through two outer rows of columns would have been more striking,—there would have been sufficient space within, and also far greater variety in the general composition. As it is, we suspect that, however good it may be in itself, such display of columniation will be upon the whole rather prejudicial than otherwise, inasmuch as all the rest is likely to fall very short of the architectural pretension made in regard to columns. The omission of the four centre columns of the second range might therefore be rather an improvement than the contrary, for at any rate then some space would be gained—perhaps some monotony also avoided, while the two remaining columns would give all the greater expression of solidity to the angles where the octastyle advances before the other colonnades.

Should there be nothing else that will contrast "timorously with the columnar pomp here affected, one thing there will be which cannot fail materially to impair whatever dignity is thereby aimed at. The door, it will be observed, is placed between two engaged columns at the same distance from each other as the rest, and must therefore be of exceedingly insignificant size in proportion to the scale of the order, the width of the opening not much if at all exceeding the diameter of one of the columns, low it must also be in the same degree, and will, besides, look quite squeezed in between the columns truly a most splendid and august portal for that of a national museum![1] With such a door, and with windows also, the general character of the design will be anything but classical or imposing, in spite of the show made by columns. Columns, however, constitute the alpha and omega of Sir Robert Smirke's architectural ideas, and capability of design—we had nearly made a mistake and said, his powers of invention, but invention he neither has nor pretends to have. Whether he intends on this occasion to stretch a point, and give us—not anything new, but some variation of his usual Ionic, some richer example of that style in regard to the capitals, and something less mean and dowdyish than his entablatures hitherto have been, we know not yet unless such be the case, even his colonnades—letting alone all the rest—will form but a very sorry "set out."

It is possible that, having only the plan to go by, we may have misconceived some matters, and may in consequence have expressed ourselves more unfavourably than we might have done could we have inspected the model. If *that* would at all refute the injurious surmises now spreading abroad, the withholding it from the public is no less foolish than it is, at the best, ungracious. However, the public voice may even yet prove too strong for Sir Robert Smirke and his supporters—and his admirers, too, if he really has any now, which we very much question.

Lengthy some may say tedious—as our remarks have been, we could very easily have extended them, because we have only animadverted upon it as it is, without pointing out what might have been introduced into it. Still one circumstance remains to be noticed, more especially as it does not show itself in the wood-cut plan, which is, that in addition to the main building, there will be two subordinate wings or ranges of building for the official residences, and these cannot fail greatly to interfere with the general effect—to detract from and neutralize the display made by the façade itself, unless they were to be altogether shut out from view by screen walls, adorned architecturally perhaps, with Doric colonnades, thereby continuing such porticos along the sides or ends of the front court, and yet with some variation of character.

[1] So far from showing any improvement in respect both to the entrance itself and to commodiousness of space the portico of the Museum threatens to be considerably inferior to that of the Post Office, and hardly better than that of the College of Physicians.

A CONTOUR—GRAPHIMETER.

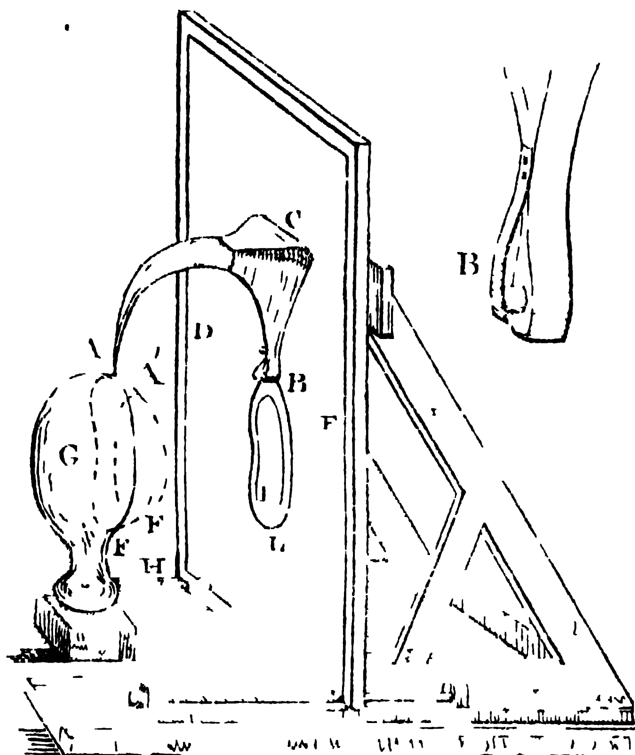
Sir—In the accounts published in your valuable journal of the meeting of the British Association at Cork, I observed a statement respecting the progress made in the contouring of maps by Captain Larcom. I have addressed myself to you in order to give publicity to my claims for the application of a method of contours in delineating another kind of object. It was some years ago my attention was directed to this subject, and since then I have fallen, I think, on the rationale of the correspondence between the representation of an object by contours, and the drawing of the same in the ordinary way. In all drawings, the outline being of course first made out, we next proceed to give the appearances of solidity, or roundness, or flatness, to the figure. Now this may be done in two ways very different from each other, one by means of shadow and shading laid on smoothly, and of various depths in the proper places, but another by employing lines only of a form suited to the shape of the model. We find the latter method employed in academical drawings and line engravings, where round limbs are faithfully imitated with circular sweeps of the chalk or graver, and objects bounded by plane faces, as walls, &c., are lined and parallel, and whilst other lines are generally necessary over these to shadow the parts, still they also partake of the form of the surface, and thus I conceive mainly concurs in assisting the spectator to form a judgment of the shape of the object the artist intends to portray.

It is easy then to see that a good drawing may be made without shading, and consisting only of lines, properly shaped of course, and more or less close according to the varying inclination of the surface. Any one who examines a clever pencil drawing will see ample illustration of this in many parts of it. But the best proof in favour of this method is the well known medallion printing, where the drawing is so true to nature that the surface of the figure appears to rise above the ground. Now the machine used in this beautiful art is liable to create considerable distortion, and cannot be used if a bust or solid object is made the subject of trial. In 1839, while on service at Malta, I constructed a new machine acting on a modified principle, by the use of which all distortion was avoided, and I proved its efficiency satisfactorily to myself by copying some small casts. I had long felt the want of some such instrument, for I had had repeated opportunities of collecting casts both of remarkable living individuals and other subjects but the limited space allowed to an officer on board a man-of-war precluded any attempt to form a collection of them, and therefore a machine to copy and measure these in every dimension, back as well as front, was a great desideratum, inasmuch as it flattened, as it were, solid objects, and enabled them to be so packed that a hundred casts might be put into a portfolio. Now the machine to which I allude is contrived to give all the outlines of successive planes of parallel section, or contours as they have been aptly called, and here I beg to remark the coincidence between the contours of Captain Larcom and my section drawings, not that Captain L. may well deserve all due praise for his important applications of the principle, but that it may not be forgotten that the same had been devised and put in practice by me in 1839. I have said that the machine measures as it draws—I mean that any measurement in any direction may be readily taken from the drawing. Now this is important to those who wish to copy subjects in illustration of national or individual peculiarities of countenance or form of skull in tribes of men or species of animals. It therefore commends itself strongly to those who cultivate physiognomy or phrenology in the practical way of comparative measurement. I proposed it once to an eminent phrenologist, who stated that such an instrument was indeed very much wanted, but he thought the photogenic process would in time supply that want. From this opinion I have reason to differ, as I believe none but linear drawings will ever give the necessary basis of measurement.

The annexed engraving is a representation of the instrument. A B C is the drawer or part moveable by the hand, it is so constructed

with regard to its flat foot or base, BC, that it keeps the point A always perpendicular to the plane DE of the drawing board at the point B: thus the line AB, in every position whatever of the sliding

Fig. 1



drawer, ABC, keeps always parallel to itself, and, therefore, if a pencil is placed at B, whatever A traces at one end is drawn exactly at the other by that pencil. If A traces the contour AF, B draws the contour at BI. When it is requisite to draw another contour the drawing board is screwed back the distance required by the adjusting screws HH, then the point A will trace another contour AF, which of course is drawn at BI as before. In this way the whole schist, G, may be traced over. It is hardly necessary to notice that if a metal plate be substituted for the drawing paper, and a graver for the pencil, we may secure an engraving plate, whence copies may be taken.

By this apparatus profiles of the countenance, of architectural mouldings, and models of maps, may be taken without the use of the ..., and if constructed on a large scale, the lines of a boat, &c., may be taken with ease and expedition.

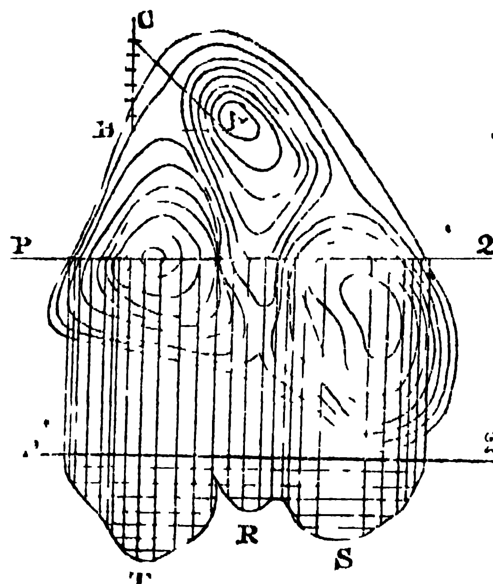
If it be desirable to make a drawing having the effect of a picture, the contours should be drawn close and blunt, but if an instrument drawing, they must be wider apart and sharp, so as to produce no confusion when the back parts are traced over.

Fig. 2 represents a plan of a piece of land, on the hills ... drawn in contours from a model, each contour representing a section of the surface at certain given perpendicular distances, say one inch of the model: then, by taking the outer contour as the base or datum, each contour within will represent so many inches perpendicular above the base; it will thus be seen that the height of the hills in the model by the innermost plan are respectively 6, 6, and ... inches above the base.

If it is requisite to find the distance on the surface between A and B, i.e. how far they are apart on the original model. From B or A, as is convenient, draw a perpendicular BC equal in height to all the sections between A and B, then will the line AC be the distance on the surface between A and B.

Suppose it be required to make a section of a crest from P to Q, of which fig. 2 is a drawing, it will be first necessary to draw perpendiculars from the several intersections of PQ with the contours by means of parallel rulers, and then taking P Q for P Q at a distance

Fig. 2



from the drawing, to avoid confusion, draw parallel lines to it distant from each other the height of each section. Where the former intersect the latter, draw the outline PTRSQ, which will give the section required. In the same manner a measure may be taken from the back to the front also, because the machine can draw, if necessary, the contours at the back within the same space as those of the front, and thus a solid object is drawn back and front from one point of view, and measured in every possible direction.

I have the honour to be, Sir,
Your most obedient servant,
SALTER LIV[illegible], M.D., R.N.

GYPSOGRAPHIC SKETCHES FROM THE PRIORY CHURCH OF ST. BARTHOLOMEW, SMITHFIELD.

With a Gypsographic Drawing, Plate XII.

Amongst the great facilities which the metropolis affords for a school of architecture, must not be omitted the many monuments of different styles which it possesses. With regard to the early periods of English architecture, many admirable specimens exist which, although abounding in points of interest, are not adequately studied—in some cases, indeed, are not adequately known. Many of these, from their recent restoration, have, it is true, attracted public notice, but many others, of no less merit, remain in comparative obscurity or neglect. To enumerate all the metropolitan works of the middle ages would be impossible, but to remind the student that they are not contemptible we may call to his notice Westminster Abbey and the Chapter House, Westminster Hall and St. Stephen's Chapel, St. Mary Overy's,

This method of Engraving (of which our present *Journal* contains several specimens, particularly those in this article of the Priory Church of St. Bartholomew the Great,) is a recent invention which bids fair, if it continues to progress with as rapid strides as it recently has done, to effect a very considerable revolution in the art of engraving, more especially in that department of the art termed wood engraving, or engravings printed from the surface at the type press. Our readers are doubtless aware that in the latter process a drawing is made by the artist upon a piece of box wood in pencil, and that those portions of the wood or block uncovered by the drawing are

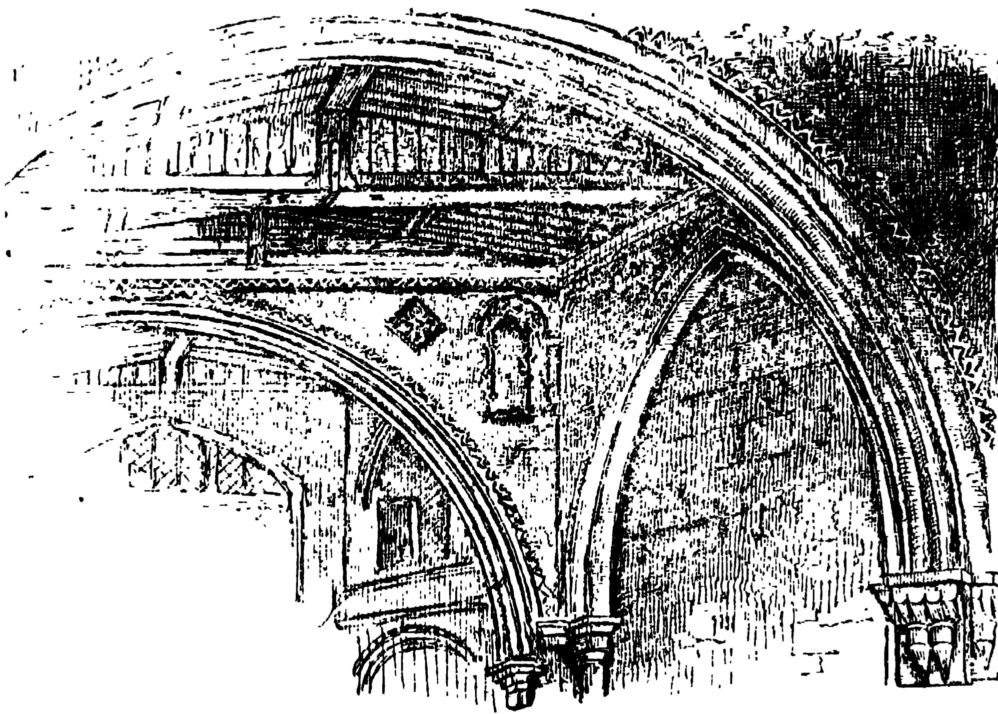


Fig. 1.—View of Arches of the old Tower and Transepts.

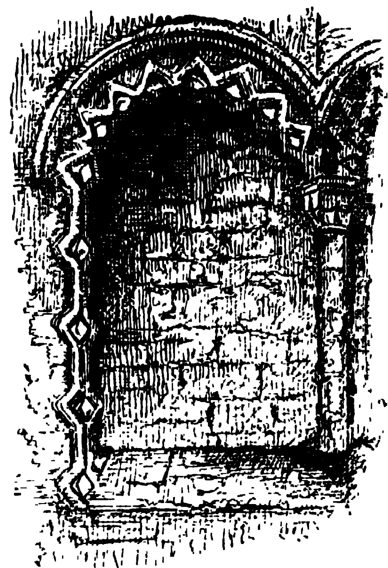


Fig. 2.—Arch in spandrel

Fig. 3.—Prior Rahere's Tomb.

SKETCHES FROM THE PRIORY CHURCH OF ST. BARTHOLOMEW.

Fig 4



Fig 8



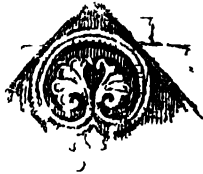


Fig 7

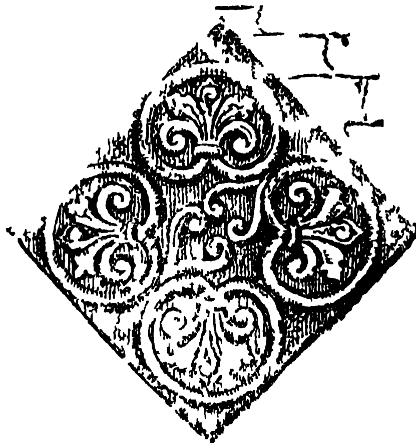


Fig [illegible]

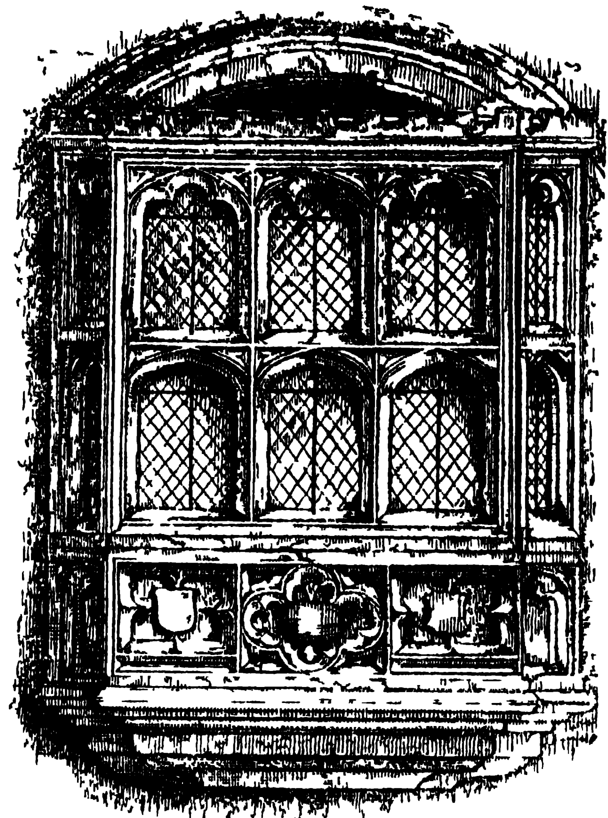


Fig [illegible]

the Temple besides many others Several of these present points of great interest, and we hope we shall be affording some gratification to our readers by devoting a series of illustrated articles to the architectural antiquities of the metropolis and its vicinity The subject we have selected for the present occasion is the church of St Bartholomew the Great, in Smithfield Smithfield is a place it might be thought but little attractive for the architectural or antiquarian student and yet to both it is of equal interest Originally a large fen or waste draining, probably into the river Fleet or some of the then pure streamlets of the city it was in the twelfth century in a very neglected state occupying a much larger district than now and used as a market the higher ground being the site of a gallows for thieves, and the scene of frequent executions It seems to have been at that time the property of the crown and lying outside two of the city gates it attracted the notice of the founder of more than one religious house as the convenient site of a large conventual establishment The priory of St Bartholomew was founded on the south that of St John of Jerusalem on the west and that of the Carthusians on the north and of their remains and in the disposition of the modern buildings are to be found many interesting architectural relics, and very good studies of the arrangement of the ancient religious houses Three establishments St Bartholomew and Christ's Hospital and the Charter House keep up the hospitallary character

The convent of St Bartholomew the Great was founded about 1113* by Prior Rahere who begged the site of King Henry I for Black Canons of the order of St Augustine and upon the strength of a legend that it had been hallowed by King Edward the Confessor obtained abundant alms from the Saxon people of London Some [illegible] have supposed that the present edifice is founded on one of Saxon origin as to which no records exist but it is not improbable that some Saxon chantry or hermitage might have existed here It is such a spot as the religious men then often chose outside the city walls close to a main road and on the scene of traffic and of death, it would be a tempting settlement [illegible] it was by no means uncommon for religious houses to be instituted on such foundations and we may well suppose Rahere to have occupied some deserted oratory or cell Be this as it may the bulk of the existing structure is clearly of Norman origin and was raised by Prior Rahere during his lifetime, under the direction of Alfune, who built St Giles's, Cripplegate It was abundantly

* The Cottonian MSS Vespasian Book IX says in one place, 1103, another 1113, and according to Dugdale it was 1123

carefully removed by the wood engraver, a process extremely expensive tedious, and often unsuccessful in producing the effect intended by the designer, all which evils appear successfully removed by this new method The finer descriptions of wood engravings are also at present extremely limited in size owing to the impossibility of obtaining the material box wood of a larger size than six or seven inches square but by the Gypsographic process there is no limit to size It may be necessary to explain the term Gypsography it derives its name from Gypsum or Plaster of Paris which forms the etching ground used in this method

The extreme simplicity of this invention is not the only great advantage it offers to the artist, draughtsman, or engraver, and may be readily understood by the following description

A plate of copper is thinly covered with a composition of which plaster of Paris forms the staple ingredient and through which to the surface of the copper, the drawing or design is etched with an etching point when the etching is completed the plate having the lines sunk in or drawn through the composition forms a matrix or mould, the plate then is cast in type metal by the stereotyping process, and a perfect cast or block is taken reproducing an exact facsimile of the artist's original design and which may be immediately transferred to the hands of the printer

Wood engravings have hitherto been the only description of illustration capable of being conjointly used and printed with type, the great cost both of engraving and printing on steel or copper having been an insurmountable barrier to the general use of the latter in illustrating works requiring pictorial additions, but now as the Gypsographic process combines with it all the advantages of wood engravings both in printing and effect as well as many of the peculiar advantages of steel and copper plate engravings, we have but little doubt it will be generally and extensively used in the illustration of all descriptions of bookwork Messrs Milner & Co the patentees of the process have several specimens exhibiting the art applied in a variety of ways which they will be most happy to show to any person who may favour them with a visit at their office in Racquet Court, Fleet Street.

strengthened with privileges some of which are enjoyed by the inhabitants of the [illegible] to this day. It is [illegible] that the present church is only part of [illegible] larger structure, and we shall endeavour to give some idea of its former extent and its present remains. On entering from Smithfield, a nave [illegible] extended to the [illegible] of the present church [illegible] [illegible]

[illegible] Of the [illegible] buildings, the nave, the transept, the great part of the [illegible] the chapel, the chapter house [illegible] the upper part of the tower [illegible] destroyed. The [illegible] We [illegible] however, that the entrance to the [illegible] and form an entrance [illegible] Smithfield [illegible] admired and is composed of a pointed arch [illegible] within [illegible] The eastern cloister [illegible] though the lower part of [illegible] that it has suffered much of late years from the fall of the roof and part of the wall, and consists of [illegible] arches more or less entire on the eastern side, and one on the west, besides a portion attached to the church, which is complete, but is walled up. The workmanship is said to be very fine, the breadth about 15 feet, and the length about 95. The refectory is also described by the same writer: "It is now occupied as a tobacco manufactory, and a large portion of it still forms but one apartment, ceiled over with oak of the finest kind and condition. There are now two or three stories, but after a careful examination of the general arrangement of the multitudinous timber of the roof of the highest story, we cannot but express our opinion that the whole has been open from the first floor to the roof, and that the latter has formed one of those oaken coverings of which Westminster Hall is so magnificent an example, though most probably of a ruder character. All appear to show that there was but one story, one room [illegible] a glorious room it must have been, measuring some forty feet high, thirty broad, and a hundred and twenty long. The crypt under this magnificent hall is of the same extent but crossed by [illegible] It has a double row of aisles of pointed arches, and is in an excellent state of preservation. The prior's house is now used by a firm of manufacturers, and [illegible] further in pretty good preservation. The length is about 87 feet.

The external appearance of the church requires no description, being [illegible] with facing of brick and [illegible] composed of the under part of the tower and the [illegible] round [illegible] aisles separated from the choir.

The tower [illegible] formed by four arches [illegible] as shown in the accompanying illustration, Plate XIV, [illegible] four form an oblong tower [illegible] we turn round arch [illegible] rather rudely formed. The [illegible] arches have [illegible] the same [illegible] mouldings. Figs. [illegible] the [illegible] arches spring from corbels (figs. 5 & 6). In each of the spandrils close to the angles [illegible] smaller [illegible] nearly at right angles to each other, one of them is shown at large in fig. 2, with a peculiar [illegible] or indented border, and a column in the angle. There are also in the spandrils small lozenge shaped panels remarkable for their singularity, the ornament of three of them shown in figs. 7, 8, & 9 are something similar to the Grecian honeysuckle.

Fig. 6. Section of arch.

This part of the church is of the greatest interest, the mixture of the pointed and round arch seems to point to the contemporaneous use of the two styles at the period of the transition, and has been the subject of much controversy, and Mr Britton (Chronological History of Christian Architecture in England) says "The [illegible] is evident, for those sides of the tower being much narrower than the east and west divisions, which are formed of semicircular arches, it became necessary to carry the arches of the former to a point in order to suit the oblong plan of the intersection, and at the same time make the upper mouldings and [illegible] range with the corresponding members of the circular arches." Whether this be the cause or not, it is not easy to determine, but the two sets of arches [illegible] almost without question to be of the same age.

The choir, which is in continuation of this tower, is in three stories, the lower part is in the Norman style, resembling some parts of Winchester cathedral. On each side are five round headed arches, ornamented with a billet moulding, a peculiarity connected with which is that it is in some places carried over the [illegible] of the column to the next arch. The second story consists of a triforium of five arches corresponding with the lower story. Each opening is divided into four by small columns and round headed arches. On the south side one of the openings is occupied by a beautiful oriel window (fig. 10) built by Prior Bolton (about 1500). Above the triforium is a clerestory of pointed windows, and the piers are pierced longitudinally so as to form a gallery all round the upper part of the choir. The roof is of timber and not very remarkable in its construction or very handsome. The east end is of modern workmanship by Mr Blyth who repaired the church lately, and contains in the lower part a range of round headed arches. In repairing this part, the stone wall behind it was found to be painted in water colour of a bright red spotted with black stars. We think it a great pity the church is not so painted now, instead of the abundant supply of whitewash.

Behind the altar is a chamber supposed by Mr Godwin to be the chancel, the interior of which well merits inspection, and which it is desirable should be thrown open to the church.

The aisles are about twelve feet wide, arched in the simple Norman style, lighted with windows of various dates. Over the south aisle is a school room, or vestry, containing a beautiful Norman arch. The vestry which is attached to the south aisle seems to have been anciently an oratory dedicated to the Holy Virgin.

The choir and aisles contain many ancient and interesting monuments; the most remarkable of which is that of Prior Rahere, the founder, which we have selected for one of our illustrations (Fig. 3, plate 14). We find the monument of the founder in the north eastern corner, almost immediately opposite the beautiful oriel window which Prior Bolton there erected, in order perhaps that while he sat in it the [illegible] home of the ashes of his illustrious [illegible] for ever before him. This is a work in every way worthy of the [illegible] It is one of the most elegant specimens of the pointed style of architecture, consisting mainly of a very highly wrought stone work, enclosing a tomb on which Rahere's effigy extends at full length. The roof of the little chamber, as we may call it, is most exquisitely groined. At what period the monument was erected is uncertain, but the style marks it as of a later date than that of the founder's decease. But it was most carefully restored by Bolton (about 1500), and the fact is significant of its antiquity. As the latter found, no doubt a labour of love in making these reparations, so time itself seems to have seconded his efforts, and to have shared in the hopes of its builders that a long period of prosperity should be granted to it, by touching it very gently. Here and there the pinnacles have been somewhat diminished of their fair proportions, and that is pretty well the entire extent of the injury the work has experienced. The monument, it must be added, is richly painted as well as sculptured, and shows us the black robes of Rahere and of the monks who are kneeling at his side, the ruddy features of the former, and the splendid coats of arms on the front of the tomb below." There are also other monuments of interest, as those of Sir Walter Mildmay, and Archbishop Walden, Lord High Treasurer, remarkable for his patriotic resistance to the See of Rome.

As to the dimensions of the edifice great uncertainty prevails. Mr. Godwin has given no measurement. Malcolm gives it as 133 ft. long, 60 ft. broad, and about 40 high. Osborne [illegible] 132 ft long, 57 broad, and 47 high.

[illegible] London, No. 29, p. 50, Charles Knight.
[illegible] London, p. 109, says eight arches in his time.

Churches of London, by G. Godwin, Jun. and John Britton.
Malcolm's Londinium Redivivum, Vol. I. [illegible] Knight's London.

WINDOW FOR A LUNATIC ASYLUM.

Sir—The humane treatment recently observed towards unfortunate individuals labouring under the affliction of lunacy rendered it necessary that extensive alterations should be made in the establishment provided for their reception, and in consequence, architects were invited to send suggestions for the improvements of St. Patrick's Hospital (Swift's) in this city, and [illegible] submitted by me, were approved. The most important arrangement was the window, in which it was indispensable to obtain strength, ample light, and ventilation without having any appearance of confinement, and if possible produce an elegant and cheerful effect, proper provision being made for the easy repair of them when required. In all these I succeeded, and as many of your readers may be called upon to make similar alterations [illegible] of service, if you think so I have sent you herewith a plan, elevation and section of the window, to which you can give publicity. I may observe, that I should have preferred having the window a little wider, but did not think it prudent to disturb the old arches, the windows being numerous, thirty-one in each corridor in a length of 500 feet.

I have the honour to be,
Sir,
Your obedient servant,
Henry Hill, Architect.

16, Tillet Street, Dublin.

Fig. 1. Fig. 2.

Section. Elevation.

Fig. 3.

Plan.

Description.

The sashes are made of cast iron 1½ inches thick, fixed in Memel frames in three parts, the centre one being immoveable, the top and bottom sashes are hung separately [illegible] inches deep, and allowed to open to the extent of [illegible] inches only, stops being fixed upon the frames to prevent their opening wider. The pulleys are placed [illegible] and below the opening points, A A, fig. 2, of the sashes, so that no apparatus is perceptible. Small rollers are placed in the sashes to assist the action and to obviate the cross binding which frequently takes place in small sash. A bracket is cast to the top [illegible] by which means the sash is opened, [illegible] are cast on the centre [illegible] at the [illegible] The frames are made of 1½ Memel [illegible] D D, fig. 2, [illegible] at the bottom to get [illegible] D D, fig. 1, to remove the upper [illegible] be readily [illegible] when required. [illegible] bars were placed [illegible] and the windows being placed very high [illegible] and the [illegible] appearance they now present a cheerful aspect, [illegible]

[illegible]

ON THE ADVANTAGES OF EXTENDING INLAND STEAM NAVIGATION IN INDIA.

India presents to the civil engineer and architect the country of almost illimitable field of action [illegible] and profitable employment. Its rivers [illegible] of the world [illegible] with all that [illegible] wheeled [illegible] from the [illegible] suitable to their traffic. Its plains are impassable from the want of roads, its roads [illegible] are useless from the want of bridges, its mines are [illegible] from the want of [illegible] manufactured products [illegible] from the want of skill and machinery, and in fact in every department of agriculture, manufacture, and commerce, the want of [illegible] and of the appliances of steam and steam engines, railroad [illegible] is most distressingly felt throughout India.

We have [illegible] the [illegible] country, to which [illegible] [illegible]

The [illegible] steamers on the Ganges has lately become of great magnitude, and by this mode the [illegible] with Calcutta and the great cities on the Ganges, Moorshedabad, Patna, Ghazeepoor, Benares, and Allahabad, on the Jumna, is found to be, even at the present high rates, the most economical, as it is the most speedy. The natives of India, as well as the European merchants and residents in Calcutta and in the interior,

[illegible] as well as other European improvements [illegible] that, in the depressed state of the iron [illegible] have not been able to supply the requisite number [illegible] fitted for navigating these rivers [illegible] turning machinery [illegible] be borne in mind that, although [illegible] the richest iron mine in the world [illegible] the prepared material [illegible] apply of machinery [illegible] iron.

The [illegible] of traffic on the Indus [illegible] Dr. [illegible] with Scinde [illegible] Although the [illegible] of the people [illegible] the hope of mercantile interchange [illegible] with them [illegible] the country [illegible] to trade and property [illegible] the Indus the [illegible] introduction [illegible] which [illegible] climate resembling [illegible] well in the [illegible] of British [illegible] and [illegible] intelligence and enterprising [illegible] and reward. In the preface [illegible] narrative [illegible] In the [illegible] 183[illegible] [illegible] and [illegible] of [illegible] the first [illegible] ever entered the Indus [illegible] teeming with [illegible] the products of the [illegible] not only for private speculation, but [illegible] investment [illegible] Maharaja Runjeet Singh himself.

There is abundance of coal in the several districts of Bengal, and [illegible] on the banks of the Indus [illegible] of coal abounds, which [illegible] little doubt that coal will eventually be found [illegible] of this river.

An estimate of [illegible] £12,000 [illegible] 100 [illegible] and 50 passengers [illegible] the total [illegible] The profits may be [illegible] estimated at 20 per cent.

It is to be hoped that [illegible] of America will [illegible] and that with [illegible] corresponding improvements will take place in the [illegible] of the staple [illegible] such [illegible] in which [illegible] of which we have [illegible] to depend [illegible] competition [illegible] countries [illegible] of this wealth, and diminish [illegible]

TO PREVENT DAMP PENETRATING THROUGH WALLS.

Some distinguished French chemists have lately directed their attention to the means of excluding damp from the internal surface of walls. The following is a translation of some observations on the subject by M. M. [illegible] and D'Arcet. The experiments made by them were begun in 1813, when M. Gros undertook to paint the cupola of the church of St. Geneviève (then called the Pantheon). "The surface of the cupola had been previously prepared like a primed cloth: after the stone had received a coat of strong size, a ground of white lead and drying oil had been superadded." Seeing that this priming was not sufficiently firm, M. Gros came to consult us. We did not hesitate to say it was far from safe. The moisture might in time, we observed, act on the size, and a painting executed on such a ground would consequently change. We came to the conclusion, that it would be necessary first to saturate the stone as deeply as possible with an unctuous substance, liquified by heat, and which, solidifying as it cooled, would stop up the pores of the stone. We were strengthened in this view by the authority of the ancients, who sometimes passed melted wax over the surface of the walls which they intended to paint, and we were induced to try a coating of wax and linseed oil, rendered drying by litharge. "After some experiments on stones similar to those of the cupola, we were led to prefer a composition, consisting of one part wax and three parts oil boiled with one tenth of its weight of litharge. The absorption took place readily by means of heat, and the liquid penetrated the stone to the depth of from a quarter to half an inch. The composition as it cooled acquired solidity, and in six weeks or two months became hard. Having made these experiments we proposed to adopt the same means on the cupola, and the operation was to be conducted as follows. The surface was first to be scraped, so as to entirely remove the paint and size, and lay the wall bare, then by means of a portable furnace, the whole superficies was to be heated, about a square yard at a time, and the composition was to be applied at a temperature of 100° with large brushes. The first application being absorbed, a second was to be added, and so on till the stone should cease to absorb. To promote the absorption the stone was to be warmed repeatedly according to its porousness. In every case the heat ought to be as great as possible, but not so as to carbonize the oil. At length the stone being saturated to a certain depth with the composition, and the surface being smooth and dry, it was to receive a coat of white lead mixed with oil, and on this preparation the painting was to be executed. Our plan was adopted and put in execution, and thus M. Gros was enabled to produce a new masterwork which could undergo no change, except that which light and air might occasion. Drops of water like dew, which covered the whole surface of the cupola every morning at first alarmed the artist: the drops appeared and disappeared without the slightest bad consequence, and a trial of 15 years has now dissipated all apprehension. A letter is then inserted from Baron Gros certifying that in the course of 15 years his work had undergone no change. The memoir goes on to state that four pendentives in the same church painted by Gerard were prepared in a similar manner. In this case the stone was so hard that the composition could not be made to penetrate more than one-eighth of an inch. The result was however quite satisfactory. The painting by Gros was first begun, as before stated, in 1813, and has been recently examined with a view to its state of preservation, it has been pronounced to be in a sound and apparently unchanged condition. For ordinary purposes resin might be substituted for wax, the ingredients then are one part of litharged oil to two or three parts of resin. (Appendix to the second Report of the Commissioners of the Fine Arts.)

WIRE ROPES.

Steam Wire Rope Works,
Gateshead, 28th Sept., 1843.

Sir,—In your magazine for July, in giving an account of the launch of the "Great Britain" at Bristol, it is stated that she is to be rigged with *wire ropes* made by a Mr. Andrew Smith; we beg to inform you that the wire rigging used on board of her was manufactured by us some time previous to her launch, and beg to annex a copy of a note from T. R. Guppy, Esq., the builder of the "Great Britain," which we will feel obliged by your inserting along with this in your next number.

We are, Sir,
Your obedient servants,
R. S. Newall & Co.

Great Western Steam Ship Works,
Bristol, 4th September, 1843.

Gentlemen,—In reply to your favour of the 2nd inst. I beg to inform you that the whole of the iron wire rope used on board the Great Britain is of your manufacture, and that I decided on adopting it after testing its strength against other specimens.

I am, Gentlemen,
Your obedient servant,
Thos. R. Guppy.

Messrs. R. S. Newall & Co.
Gateshead.

THE PHILOSOPHY OF CORAL FORMATIONS, AND THEIR ARCHITECTS.

No. II.

According to the doctrine of the Pythagoreans and Platonists, there is life in all things, the living principle being omnipresent and inseparable from matter, regulating, modulating, and reconciling the various actions and parts of this mundane system. This living principle is the electric fluid of modern philosophers, being equally manifest in the living, the fossil and mineral kingdoms, giving form and properties to all: thus plants are distinguished from minerals only from their flexile nature, which enables them to multiply their parts and quantities to a certain extent without impeding the action of the living principle: the line of division of the animal, the vegetable and the mineral, is *life*, the link of life being one unbroken chain, commencing with the, to us, invisible point, and ending in the beautifully complicated mechanism of man. life in all being a measure of quantities and a measure of motions, continually varying, and finally dissolved. The great inherent property of organic life is to condense the elements, and to unite them in fixed and definite proportions within the body as animal and vegetable matter, which on the cessation of living action, becomes under many new combinations, fossil and mineral matter. The living and the dead are bound by the same chain of necessity for the preservation of form and quantity, and for the capacities, qualities, and powers which they severally develop, cause depending upon cause, effect depending upon effect.

In the lowest development of life, plants and animals closely approximate to each other in external character, the animal assuming the plant-like form, and multiplying by involuntary action, as is manifest in millepores, sponges, tubipora, and some species of coralline, and from thence distinguishable from vegetable species by voluntary action. In these orders and in monas, the line of demarcation as established by naturalists is removed; the zoophytes increasing by the vegetative process, their growth being perpendicular to the plane of position, although not invariably so, for many species of coralline have root, stem, and branch, the root increasing with the increase of the superstructure. As life advances in the scale of organization, so the distinction becomes apparent, until it becomes strongly defined, every advance in the organical structure being indicated by the development of organs peculiar to the animal, and explanatory of its habits and character.

Linnæus observes, "all calcareous substances are most truly of animal production; therefore corallines consisting of that substance do certainly belong to the animal kingdom:" but even admitting this to be true, it offers very little assistance to us, when we attempt to classify oceanic animal and vegetable life, as exhibited in the numerous species of naked polyps and sea weeds. On the other hand, it requires no very great stretch of imagination to suppose that plants having great absorbent powers and disposed very often on a calcareous soil, or otherwise in waters holding in suspension carbonate of lime, should receive and retain within their system or become enveloped with a crust of this material.

Mr. Ellis, demonstrating the animal nature of corallines, tells us that the softer and harder parts of zoophytes are so closely connected with one another, that they cannot separately exist, being constituent parts of the same body, the polype-like suckers being so many mouths thereto. This is correct, as regards species having these suckers, and is equally applicable to many of the stony corals, the suckers being the seat of sensation and voluntary action of all that part of the calcareous base which admits of the ingress and egress of the circulating fluid. The branchiform corals have their suckers disposed at the extremity of the branches and offshoots, and through these alone the whole body receives its nutriment, and by their expanding and contracting action and conducting powers of heat, the descent and ascent of the circulating juices is regulated. The cellular cavities covering the main trunk and branches lined with a membraneous substance bear no similitude to the suckers disposed at the extremities, nor do they perform the like duties, but similate more to the respiratory vessels of plants, gradually diminishing in size, and eventually when the entire form is developed, closing altogether, leaving the trunk still accessible in all its parts, until the whole lower portion consolidates, or it becomes entombed by increasing generations. It is certainly a mistaken notion that every cell throughout the body is the habitation of a polyp, for while we admit that animal matter pervades the whole body, we can only admit it to be one body in entirety, increasing and propagating through the instrumentality of its suckers which perform the active duties, conducting the food into the main trunk and branches, wherein it is elaborated into lime, gelatine, oil, phosphorus, and other peculiar compounds, the body fixed and immoveable being the passive medium of action, and receiving increasing size and solidity from continued accession of elaborated matters.

Ehrenberg tells us that tripoli, chalk, and other substances, when microscopically examined, display a cellular structure, the tenanted and untenanted habitations of polypidoms; and that every cell is undoubtedly the habitation of a polyp living, maturing and generating, independent of those connected with it. The radiate corals are of compound animal formation, the several tentaculæ or suckers being one body, united at the base, and governed by the one impulse; thus it is their growth is uniform and their form defined. Each of these suckers forms during the period of its growth a series of cells or joints, which communicating with the main body, accelerate the general increase of the whole, and enable the polyp to withstand more effectually outward influences, and to propagate its species: the branched madrepores are as previously observed, of plant-like growth, covered with cylindrical turbinate pores, the whole compound body being one, and uniformly governed by one impulse.

The polypous animal like the plant is the unconscious architect of its own existence, both advance in the line of light and heat, and ramify into shoots and branches according to their cellular composition and structure, both are the unconscious agents of production and reproduction of peculiar elementary compounds, and both perform an equally important part in the economy of nature.

The very recent report of Mr. Edward Forbes on the Mollusca and Radiata of the Ægean Sea, drawn up at the request of the British Association, confirms in a most remarkable manner the laws I have laid down as regulating oceanic animal and vegetable life, in disposition, quantities, and qualities illustrating the progressive development of species, habit and character, and consequently the gradual development of the fossil and mineral kingdoms He observes, that in eight distinct regions of depth, each presents its peculiar association of species defined between 0 and 230 fathoms; the most superficial of these, although the least extensive, having a depth of only two fathoms, being most prolific of animal and vegetable life, and most various in mineral character. The second region ranges from 2 to 10 fathoms, the third from 10 to 20, the fourth from 20 to 35, the fifth from 35 to 55, the sixth from 55 to 75, the seventh from 75 to 105, the eighth exceeding in extent all the others combined, ranging from 105 to the lowest depths explored, and presenting a uniform mineral character throughout and peculiar fauna. Certain species were found to range through several of these zones, and two through all. *It was found to be a law, that the extent of range of a species is correspondent with the extent of its geographical distribution.* On the other hand, species having a very limited range in depth were found to be either peculiar Mediterranean forms, or such as are extremely rare in the Ægean, but abundant in more northern seas. The testacea of the Ægean are for the most part dwarfs, as compared with their analogues in the ocean, and the number of medusæ and zoophytes are comparatively small. Below the fourth region in depth the number of animals diminishes as we descend, until, *in the lowest part of the eighth region the number of testacea was found to be only eight.* In the upper regions the more southern forms prevailed, whilst those of the lower zones presented a northern character, *indicating a probable law*, that in the distribution of marine animals, *regions of depths are equivalent to parallels of latitude.* A corresponding succession and replacement of forms by similar forms was discovered in depth. Each species attains a maximum in development of individuals, and gradually diminishes in numbers as we descend; but before its disappearance in many genera, a representative species commences, attaining a maximum after the disappearance of its predecessor, and then in like manner, diminishing to a minimum and disappearing. Genera are in like manner, represented and replaced by corresponding genera. This is equally true with vegetables as with animals. Green fuci were found as deep as 55 fathoms, and millepora extends its range to 105 fathoms.

Within the waters of the Pacific Ocean several hundred thousand square miles of habitable land have been formed or are now forming, through the agency of gelatinous and lime-secreting polyps, aided by innumerable families of shell fish, marine plants, and locomotive animals with which the waters abound. Hills and chains of hills, mountains and mountain chains, running alone the tidal lines gradually enlarge their summits as these waters decrease, and for upwards of 4000 miles not a single island occurs that is not of coral formation. The great reef on the coast of New Holland extends its uninterrupted course 350 miles, and forms a continuous line with others to the extent of 1000 miles, varying in breadth from 20 to 50 miles: the lower plains of the vast continent of Australia have the like origin, and throughout the whole Australian seas there is scarcely one league without a coral reef, rock, or island, raised from the lower depths by polypous animals, though close to within the reef the sea is fathomless: thus the whole extent of this portion of the ocean is rapidly filling up, and the main continent continually enlarges its geographical area.

In the south sea, particularly to the eastward of the Friendly Islands, from the 10th to the 15th latitude, a reef of coral surrounds the island of Otaheite rising like a wall from unfathomable depths. Palmerston island, the islands of Tanea, Middleburgh, Tongataboo, Magea, and numberless islands of the South Sea and Pacific Ocean are of like formations. The coral reef and islands called the Maldives form a chain of 480 geographical miles in length, running due north and south. The whole line of coast of Eastern Africa, the island of Madagascar, and other islands scattered over the

Indian Ocean, owe their origin and increase to like causes. The islands of the West Indies and vast barriers on the shores of the main land are coralline: the Persian Gulf and the whole of the Red Sea are both rapidly filling up, the latter sea being at present barely navigable by vessels of large burthen through a very narrow channel, and by far the greater portion of the main continent of Africa and of Asia, including all the great deserts and mountain chains intersecting them in various directions. Charles T. Bell supposes the advance of land upon the gulf of Persia to be more than 280 miles since the last catastrophe; and all writers unite with him in supposing that great encroachments have, and continually are taking place in these latitudes. The clay of the Euphrates contains an excess of sodium, and on either side are immense deserts of sand, salt, bitumen, naphtha, magnesia, soda, and calcareous matter, while the hill chains dividing them, are wholly composed of matters almost exclusively oceanic. At Cutch and the whole of the northern shores of India, the land has encroached upon the sea to a vast extent; the great Run, 7000 square miles in extent, is one sandy flat containing vast beds of salt, and the elevated tracks surrounding it demonstrate their origin. The great deserts of Africa, Zaharah, Nubia, Lybia, Egypt, Mesopotamia, and many others, stretching from the Atlantic through Asia, are exclusively oceanic, the entire soil being sands and calcareous matters, beds and hills of salt, chains of hills composed wholly of corals, balani, oysters, and numerous species of shell fish, interspersed with vast accumulations of petrifactions, and the skeleton remains of fishes. Approaching towards Europe the like phenomena have been noticed so far back as the time of Diodorus, Pliny, and Strabo: further proofs of the decrease of the waters are afforded, by the fact of the drying off of large inland seas, thus the communication between the Caspian and the Black Sea, the Red Sea and the Mediterranean, have been broken off, and the vast salt lakes of Russia are standing and incontestible memorials of the seas retreating therefrom.

The Red Sea is most abundantly stored with coral formations, lime secreting animals, fishes, animalculæ and sea weeds: the vast shallows embracing full three-fourths of its entire surface present to the eye of the naturalist the stupendous workings of nature, and the primary causes of many effects manifest in terrestrial earth. Sailing over them during the long continued calms common to this sea, when not a ripple disturbs the surface of the waters, which are bright and blue as the lake of Como, the eye is delighted with the panoramic view beneath. Gardens abounding with animal flowers of every hue, the red pipe coral, green meandrina, black gorgania, and sponge, purple, blue, yellow, white and brown madrepores and millepores interspersed in clumps and groups with corallines and plants of the most delicate texture. Plains covered with green verdure tenanted by crustacea, turtles and fishes, valleys covered with a white sand, partially hidden from the view by wings, murices, sea eggs, sea snails, pens, star fish, and scarlet, soldier and hermit crabs—elevated plateaux of pearl oysters—hills of cirrhipedes, and chains of hills of reef coral, whose towering summits sometimes resemble the roofs of palaces and temples of the richest and most elaborate workmanship, from which pedunculated cirrhipedes and purple mussels are hanging in clusters, while beneath, wide and magnificent portals open into caves of beautiful coral, where the coral fish resplendent in azure and silver, and green and gold, search in numbers for their delicate food, cropping the equally gaudy animal flower from its living bud. Above, the sea teams with its living myriads of phosphorescent animalculæ, sharks, bonetas, dolphins, black fish, medusæ, and numerous other species.

The calcareous matter covering the valleys and troughs is analogous to the chalk deposits of the earth, consisting of the atomic particles, entire bodies, and portions of bodies of generation upon generation mixed with the digested matter continually deposited by the living. The sands vary in their nature and quantities, in localities being extremely fine, when formed by the death and decomposition of young mollusca, which are thrown up in vast abundance on some of the shores near which they are deposited by the current; and much coarser when they are produced by the decomposition of murices, oysters, gigantic cockles, and other shell fish having heavy calcareous shells. The outward reefs towards the ocean are invariably consolidated, consisting of the reef coral and various lime-secreting species enveloped in consolidated rising formation, the reefs always form along the tidal line, and when the rising structure causes the tide to diverge right or left, then, within the disturbed space the zoophytes cease to work, and an opening is left of considerable width and depth, of much advantage to mariners, who are thereby enabled to take refuge within the reefs during stormy weather. This outer reef presents a perpendicular wall to the tidal currents, but generally has a gentle inclination towards shores with two or more parallel chains, thus from Mocha to Yambo there is a continuous reef, and for upwards of 500 miles a triple chain of reefs is seen running parallel to the coast, and to the mountain chains of Arabia bordering the sea. The inner reefs are variably composed, their elevated parts being generally of the like conformation of the outer wall, but the interior is sometimes filled by coral banks heaped up by storms, consisting of broken coral sands and weeds; upon these, in the long continued calms common to this sea, vast multitudes of mollusca resort, which are buried in the next periodical disturbance, thus stratum upon stratum is formed, until the bank tops the water, sometimes cutting off vast tracks from the main ocean, which, when perfectly isolated, soon become a portion of the desert. The reef is sometimes formed by the united labours of numerous species of lime-secreting animals, separately working in groups and families, or confusedly blending together and embracing each other in the general ruin, the coral polyps enveloping all the crustaceæ and corallines, and the relics of the dead in their stony folds. Many entire hills are formed by particular families, such as serpula contortuplicata, balani, and white tube coral, and others are wholly formed of calcareous matters or sea weed, the whole united mass being one vast receptacle of the dead, and so long as covered by the waters, one general birth place of the living. the like phenomena of coral formations is common to all tropical seas.

Mr. Dalrymple, who first drew attention to this important subject, observes, that in the eastern seas, coral banks grow by a quick progression towards the surface; but the winds heaping up the coral from deeper water, chiefly accelerate their formation into shoals and islands. They become gradually shallower; and when once the sea meets with resistance, the coral is quickly thrown up by the force of the power breaking against the bank; and hence it is that in the open sea, there is scarce an instance of a coral bank having so little water, that a large ship cannot pass over it, but it is also so shallow that a ship would ground on it. The coral banks were observed by him in all stages of growth, some in deep water, others with few rocks appearing above the surface, some just formed into islands, and others covered with land vegetation. Bars of sand and coral also form, cutting off large portions of the waters, the isolated portion being soon filled up by this material. The violence of the waves, he observes, gives the direction and form to the reefs, which are long and narrow; but when not exposed to the common monsoon they assume irregular forms, according to the accident of circumstances. Such in truth is the origin of many coral banks; but this mode of formation cannot apply to those barrier reefs and rock built islands which constitute the by far greater portion of coral formations. It is true that all reefs receive increase by continued sedimentary depositions; but many of the inner reefs of seas being beyond the action of the storms, are entirely built up by the living architects, without the aid of broken coral and sands from deeper waters: thus all navigators speak of these enormous barriers and local accumulations as presenting seaward a solid wall of limestone of unfathomable depth, and such could not be the case were they built up by the sands and broken coral alone.

The analogous formations intersecting the earth in hill and mountain chains of limestone, oolite and chalk, give correct ideas of the disposition and shape of these reefs now forming within tropical seas, the limestone has invariably one or more perpendicular faces, the same inclination pervading the reef, the extreme height not exceeding 4000 feet: the chalk having also occasionally one abrupt face, but being in many instances dome shaped: the larger formations generally running for a considerable distance in a direct line, the smaller being grouped together, being as evidenced by their organic remains formed in the shallows of warm and tranquil seas.

The Red Sea, as previously observed, is literally choked up with coral reefs, sands, and embankments, composed of broken corals, shell fish, &c.; and the lower depths are also rapidly filling up with the finer decomposed particles of lime secreting animals, fuci and other organic remains; since the days of the Pharaohs, thousands of square miles have been abstracted from this sea, from the Persian Gulf, and hundreds of islands have reared their crests far above the surface of the waters. Sea port towns once accessible to vessels of heavy burthen, are now lost in the distant desert plain, or are inapproachable for miles. Ehrenberg tells us that the ancient harbours are filled up with the debris washed into them by storms, but this is not the fact; the present site of Yambo is on a recent coral reef, from which the inhabitants say the waters are continually receding. Djeddah is inapproachable by our vessels for two or three miles, the solid coral limestone rock approaching in all parts of this intervening space to the very surface of the waters, and Lohheih, the great coffee mart, once a well frequented port, is inapproachable for full five miles; the coast on the Arabian side is bounded by continuous reefs of recent coral, now standing from 20 to 60 feet above high water mark, and chains of lakes are formed both by this general decrease of the waters, and also by accumulating sand banks. Beds of pearl oysters, and hills of peculiar species of lime-secreting animals common to this sea, may be found many miles inland. The accumulations of coral, sand, and calcareous matter are of incredible extent and thickness, embracing many thousand square miles between the sea and the hills of Arabia and Africa. Few of the islands are or can be inhabited, being desert soil, wholly devoid of vegetation, with the exception of the amphibious mangrove, and a few stunted shrubs and coarse grasses, and such plants that love a barren acrid soil: they are the resort of pelicans and other sea birds, whose dung sometimes covers the surface to a considerable extent. In consequence of the want of rain, these islands continue bare and desolate from generation to generation.

The phenomena of coral reefs similate in all parts of the ocean where they are produced, but the after changes which take place on their surface depend

on the nature of the latitude under which they are disposed. As in the Red Sea, in the absence of rain, we find them for ever desolate; so in the Pacific and Southern oceans, where the rains are frequent, the surface soil of the islands soon acquires aptitude and power to produce vegetables, and to sustain animal life, the acrid salts and other organical compounds being washed into the waters or into the bowels of the earth, where they have united with the free alkalies: thus the island no sooner tops the wave, than the cocoa nut and other tropical plants cover its surface. In and throughout the whole, the coral formations originate from similar causes in action, the lower depths of the ocean fill up with sands, fuci, and naked polyps, upon this basis the calcareous polyp builds, assisted in its labours by numerous species of mollusca, and furnished with material by the myriads of creatures living and in death decomposing in the medium in which they are placed. Upon the ruins of preceding existencies conchifera and mollusca dispose themselves in groups and families, or are heterogenously united with the general body, adding during the whole period of their existence and by their death to the soil, and similating to the general body their elementary constituents, contributing to form the one great whole, or general sum of earthy matter. Donati speaks of the bed of the Mediterranean being filled up to the depth of 800 feet with the calcareous bodies of the dead: what then must be the depths of these deposits in tropical seas where species are infinitely more numerous and diversified, and where lime-secreting polyps build from depths unfathomable, filling up a geographical range many times larger than the Mediterranean Sea.

Nor is it to the coral polyps alone that we are indebted for the formation of islands and continents of the earth. Many localities of the deep are overspread in vast patches with fuci, which as they generate, contribute to fill up the void of waters by administering to the wants of numerous finny tribes resorting to these submarine meadows, and by contributing to the digestive process of those fishes, and, also in decomposition of their parts adding thereto. Again, the fecundity of many species is most amazingly great, and were it not for the eternal warfare waged against each other, and the numerous accidents to which they are subject, the whole ocean would speedily become corrupt with the living of the dead: thus we are told that in the ovula of a flounder of 2 oz. weight have been counted 133,407 eggs; in one of 24 oz. 1,357,400; herrings weighing from 4 to 5 oz. from 21.285 to 36,960; lobsters from 14 to 36 oz. 21.699; mackerel of 20 oz. 454.967; sturgeon of 160 lb. nearly 1,500,000; cod fish are supposed to spawn annually 9.000,000, and ling 19.218,625. Leuhenhoeck also tells us that a globular body of one inch diameter of oyster liquor may contain 1,728,000 embryo oysters, besides animalculæ, 500 times less than the spawn. The crustacea are all exceedingly prolific, and advance rapidly to maturity, and in warm tranquil seas the several varieties of shell fish are strikingly abundant; while throughout the aqueous medium fishes, animalculæ, medusæ, and other locomotive animals abound, and in their abundance contribute to fill up the valleys of the deep, and to raise the submarine hills and mountains to the surface of that element to which their operations are confined. Other causes in action contribute to the ultimate result, the waters slowly disappear, and the virgin soil which, from its base to its summit, as composed of the reliquæ of the dead, becomes exposed to new influences, whereby its future character is determined.

The number and variety of living species inhabiting the ocean, and by the functional operations of life contributing to increase the consolidated matter termed earth, is far beyond the imagination of man, and every species, from monas to the monster mammalia, derive their elementary constituents from the medium in which they move, abstracting matter from the atmosphere and from the waters, and maintaining form and characteristic properties through the agency of light, heat, and electricity, becoming wholly or partly in death a portion of the soil, and of those peculiar compounds generally disseminated through the waters. Of the food received within the living system nothing is lost, one portion adds by secretion to the rising strength and maturity of the body, and to the propagation of kind, and from thence to decay, the remainder passing out by excretion or respiration; and as the nature of the aqueous medium and the elementary influences exercised therein determines the nature of the organic body, so does the nature of the body determine the nature of the organic compound generated by living action, and the sum of existence of species uniform in their parts and qualities determines the nature of the formation produced by their combined operations. The consolidated atomic quantities, or the entire animal frame may lose a portion of their elementary constituents, which volatilize and return to the primary state, or are disseminated through the waters; but every organic body performs in its degrees the general operation of converting the elements constituting air and water into consolidated matter, or into definite results, in which their previous combinations are dissolved and new creations are formed belonging to the class of undecompounded bodies.

Oceanic species are governed by the same laws of distribution as terrestrial species, habitude being absolutely and indispensably necessary for the existence of particular orders, and for the full organical development and accelerated growth of others. Coral formations like tropical forests flourish in analogous latitudes, and if removed from those latitudes, they quickly diverge into species by losing some of their characteristic properties, and if the change be in the extreme the order becomes extinct: thus the pearl oyster and other peculiar species of shell fish degenerate as they approach temperate regions, and many of the lime secreting polyps become divested of their calcareous clothing when removed from the direct influence of light and heat. All orders affect particular latitude, dip and inclination, and although many, from their peculiar formation, are enabled to resist and overcome the destroying influences of change, by adaptation of parts to that change, others, and perhaps the more numerous, are of necessity confined to particular latitudes. As living beings all are subject to the like vicissitudes, the one species, or the comminuted or consolidated parts of the many, being the accident of production of other species, the one contending with and devouring others, the tenure of existence being perpetual warfare, species against species, life against life; in death all unite in one vast social compact, the devourer and the devoured contributing unconsciously to accomplish the one vast magnificent end, *the ultimate perfection and maturity of this planetary body*: living, they produce by their chemical and mechanical action, animal and vegetable matters, earths, acids, gaseous and etherial fluids, all of which by the unceasing generation of living beings as continually increase; i death nothing is lost, groups and families uniting to themselves countless myriads, become the architects of beds, hills, and mountain chains, the finer particles of bodies contribute with the reliquæ of fishes to fill up the troughs and valleys with marl, the sands are formed into sand banks, the fuci accumulate in vast heaps, and uniting with calcareous matters pass into the mineral kingdom as schistose rock or peculiar clay, and every organic body contributes by its death to the formation of some one particular earth.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

May 16.—The PRESIDENT in the Chair.

"*Description of an improved form of the Journals of the Axles for Railways.*" By Captain Elias Robison Handcock.

The paper commences by enumerating the principal disadvantages of the common railway axles, noticing particularly, the great consumption of oil; the wear and tear, not only of the axles, but also of the boxes and the brasses; the oscillation occasioned by the wearing away in length of the latter, producing destructive effects alike to the engine, carriages and rails, as well as being disagreeable to the passengers. It then describes the new form of axle, which it is contended is calculated to remove these evils. The chief peculiarities of its form, consist in substituting for the abrupt shoulder at either end of the journal, two cones; the outer one, which is loose on the axle, is capable of being forced forward by a screw on the extremity; it is prevented from revolving on the journal by means of a tongue, and is secured by a screw nut, and key. The two anti-friction collars of hard brass, which take the places of the ordinary journal brasses, are about three-eighths of an inch in thickness, and are fitted on the journal sufficiently loose to enable them to turn freely in the bored cast-iron boxes which support them; these collars extend over both the cones and along the journal till their ends meet within about a quarter of an inch in the centre, and acting as an independent moveable power between the journal and the cast-iron box into which they are fitted, they reduce the amount of friction when it becomes greatest. Among the advantages derived from this new form, are the uniform smooth and steady motion, consequently reducing the wear and tear; allowing the collars to be at all times tightened, avoiding the lateral action, which is detrimental to the carriages, and to the line of rails; the smaller consumption of oil; one pound of oil being found sufficient to lubricate a six-wheeled engine and four-wheeled tender, while running a distance of nearly 1000 miles, and the absence of any tendency to heat. The paper concludes, by expatiating on the benefits already found by experience to result from their use.

Remarks.—Captain Handcock exhibited the journal of a common railway axle, with its box and brasses, which had been in use, and pointed out that the principal abrasion had taken place at the ends, that a new brass for the same journal would require to be nearly an inch longer, and therefore, that the oscillation of the carriage must necessarily be great, whenever the brasses began to wear. He explained that it was usual, in order to save the expense of new brasses, to weld an iron ring upon the journal against the collar, and showed one, which had worn such a cavity in the end of the brass, as to bury itself completely within it. It appeared also that there was much wear both on the journal and in the box, and that unless an axle possessed the means of having its brasses tightened up endways, oscillation and abrasion were inevitable. A journal and its cones of the improved form, which had run over 21,000 miles on the South-Western Railway, exhibited

no visible amount of abrasion, and Captain Handcock contended that the practice confirmed his previous ideas.

Mr. Field thought the form of the axles a decided improvement. They were somewhat on the principal of those which had succeeded so well for common roads, and he believed that they must prove of considerable advantage for railways.

Mr. Fairbairn approved of the construction of the journals, and had no doubt of their practical efficiency; he particularly liked the cones, as in addition to their affording the means of preventing lateral motion and diminishing the friction, their form added strength to that point near the shoulder where it was most wanted.

Captain Handcock stated that the average consumption of oil on railways, was for an engine and tender with common axles and brasses, about 6 lb. for 110 miles; of this quantity, 2 lb. were used for lubricating the axles.

General Pasley observed that his attention had been drawn to these axles, and although on account of his official position, he scrupulously avoided giving any opinion on the merits or demerits of an invention, yet he might say that if he was a proprietor of a railway, such was his opinion of Captain Handcock's axles, that he certainly would give them a trial.

"On the application of Zinc by the process of Electro-deposition, for the preservation of Iron, as applied to Engineering and other purposes." By Frederick Pellatt.

The object of the paper is to direct attention to the properties of zinc as a protecting coating for iron; to describe the processes already employed for that purpose; the reasons of their failure, and the peculiar fitness of the process of electro-deposition of metal for the purpose. Iron is, it is stated, from its superior affinity for oxygen, liable to rapid decomposition, and it has ever been a desideratum to discover some cheap mode of protecting it; the ordinary methods of painting and tinning not being sufficiently lasting. By the laws of electricity, when metals are in contact, the negative metal is protected at the expense of the positive: and under all ordinary circumstances zinc being the positive metal, it becomes a protector to the negative metal—iron. Zinc, like most metals in commerce, is not to be met with pure; in the other metals, however, the impurities do not generally tend to the injury of the metals with which they are combined; such, however, is not the case with zinc and its impurities, as when in contact with moisture, they generate a galvanic action by which the zinc is rapidly destroyed. Those who have made use of zinc, especially where it has been exposed to exciting fluids, such as milk, or any other fluid easily converted into acid, are well aware of the rapidity of its destruction. The impurities existing in ordinary zinc are then noticed, as well as the difficulty and costliness of the process of sublimation, in order to refine it. It is also contended that impure zinc being in itself so easily destructible, is of little value, as it cannot afford protection to any other metal which may be coated with it: and therefore the mode of plating iron with melted zinc (of commerce), must be objectionable.

The Report made to the French Academy by Monsieur Dumas, is quoted, in which he says: "the zincing of iron by steeping it in a bath of melted zinc, has many inconveniences: besides, the iron combining with the zinc, constitutes a very brittle superficial alloy, the iron losing its tenacity. The presence of foreign matters used in the process, in order to keep the zinc in fusion, increases the amount of impurity, and being less fusible than the zinc, a great loss is created in consequence of the zinc volatilizing at a high temperature. It is well known that in the deposition of metals from metallic salts by the electro-process, the pure metal only is deposited, so that the process described in the paper, is not open to the objections against ordinary metallic coatings. The iron also being coated with zinc in a cold solution, its state is in no way changed. The expense of the process is stated not to exceed that of four coats of oil paint.

Though to men of science the properties of zinc in connexion with other metals have been well known, (and the opinion of Drs. Graham, Kane, Daniel, and Monsieur Dumas, are quoted on the subject,) yet practically this knowledge has not been much applied, chiefly from the difficulty of obtaining pure zinc. The electro process, it is stated, entirely overcomes the difficulty; at the same time it affords facilities for covering iron-work of any form or size, and as it requires no great outlay, the process may be carried on in any locality. Zinc has another great advantage: although it is easily oxydized, the oxyde in ordinary circumstances is insoluble, and affords a protection to the metal below. For roofing and many other purposes, of which a long list is given, it is suggested that zinced iron would be found very useful.

Remarks.—Mr. F. Pellatt exhibited a number of specimens of iron covered with zinc and copper by the process of electro-deposition, which he described. The pieces of iron were first rendered perfectly clean and free from oxyde by plunging them into a bath of heated sulphuric acid and water: they were then placed in a cold solution of sulphate of zinc. The positive pole of a galvanic battery being attached to a zinc plate, and the negative pole to the piece intended to be covered with metal, the deposition commenced equally all over it, and was continued as long as was considered necessary. By this process the pure metal alone could be deposited, and the amalgamation of the zinc and iron, which occurred when the iron plates were dipped into melted metal, was avoided. For zincing, he preferred an acid to an alkaline solution of the metallic salts. Some thin plates, which had been exposed for eight months, on roofs in London, did not exhibit any appearance of rust. The process could be applied on any scale, as all the apparatus that was necessary was some wooden troughs to contain the solution and the pieces of metal to be covered. He had not made accurate experiments as to the efficacy of the process, when applied to iron exposed to the action of sea-water, but he feared the result, on account of the formation of muriate of zinc.

The President said the subject was one of great importance to engineers, as if the deposited coating was found to stand the test of time, it would enable the use of iron to be extended; but the main point to which he would direct Mr. Pellatt's attention was the defence of cast-iron from destructive action of sea water.

May 28.—The President in the Chair.

"Account of some Egyptian Bricks from the Pyramids of Dashoor." By J. Perring. Communicated by William Newton, Assoc. Inst. C. E.

The author states that the ancient Egyptians used bricks for every purpose, except for the erection of temples and tombs; that they were generally crude bricks dried in the sun, and in the dry climate of Egypt they sufficed for all ordinary purposes. The only instances in which he found they had been subjected to the action of fire, were for a quay-wall, and for the foundations of a town near the Nile in a damp situation. From the drawings in the tombs, and the narrative of Holy Writ, it would appear that the captives were generally employed in manufacturing bricks, and as many are found with the name of the reigning monarch stamped upon them, it is not improbable that they constituted a government monopoly. It is a curious fact in connexion with the Biblical account of the labours of the Jews, that more bricks bear the stamp of Thothmes III. than of any other monarch; and according to Wilkinson and other learned authors, it was during his reign that the exode of the Israelites took place.

The bricks, which are 16 in. long, 8 in. wide, and about 5 in. thick, are made of the alluvial soil of the valley of the Nile, mixed up with chopped straw to bind the whole together. They were formed in wooden moulds, and dried in the sun. It would appear from drawings, that the earth was tempered and the straw was mixed in, by men treading the mass with their feet. With such bricks as these the Egyptians formed the walls of their towns, using the alluvial earth also as mortar. The author states that he found some remarkably well-formed arches, of 12 ft. to 14 ft. span, built in concentric half-brick rings, at Thebes, the bricks of which were marked with the name of Sesostris; consequently they must have remained uninjured by time upwards of 3,180 years. They all have a cavity in the sides to retain the mortar, similar to what is practised in modern bricks.

The pyramid from whence these bricks were taken, was built, according to Herodotus, by a king named Asychis, who lived about 2000 years before the Christian era. The body of the pyramid is composed entirely of crude brick, but it had an external casing of limestone as a protection from the action of the weather. The author says that not a single brick appears to have settled from its place, and that it is difficult to imagine a mass more solid and compact, in spite of the great pressure the bricks had to support in a pyramid of 215 feet high.

Deposit in Pipes from a Brewery.

Mr. Davison presented a piece of copper pipe, 6 in. diameter, through which the wort had been forced during a considerable period, at Messrs. Truman, Hanbury, and Co.'s brewery. It was nearly stopped up by a deposit of a black substance, which opposed such resistance to the passage of the fluid as to induce an examination of the pipes, and the discovery of their state.

Dr. Ure said that the deposit was a good example of what Leibig called "Eremacausis"—product of slow combustion. The substance was a carbonaceous matter, resulting from the slow combustion of the gluten and starch contained in the brewers' worts.

May 30.—The President in the Chair.

Corrosion of Iron and Steel.

"On the action of Air and Water, whether fresh or salt, clear or foul, and at various temperatures, upon Cast and Wrought Iron, and Steel." By Robert Mallett, M. Inst. C. E.[1]

The author in this paper gives the completion of his researches upon this subject, on which he has been engaged for nearly five years, during the in-

[1] This paper, which forms the continuation of the communication which was read before the Institution, May 26, 1840, (Minutes of Proceedings, *Journal*, Vol. III., p. 424,) occupied the attention of the meetings on two evenings.

tervals of professional avocations. The experiments, originally undertaken at the request of the British Association, had reference merely to the action of air and water on iron, in various states and under several conditions; but in the progress of research, the author has extended the investigation to many other connected branches of practical importance, such as the several modes, or assumed modes, of protecting iron from corrosion, in which he has proposed improved methods dependent upon known principles, which are developed at length, and which appear likely to be of great importance, in relation to the circumstances affecting the durability and corrosion, whether general or local, of iron ships, to which he has devoted much attention. The protective powers of various paints and varnishes have also been determined in many conditions, and the peculiar circumstances of corrosion presumed to attach to railways bars, are partially investigated.

The main numerical results of these investigations are given in two volumes of Tables, which show on inspection the absolute and relative losses by corrosion, in given times, and under six several conditions of experiments, on nearly all the various qualities of cast and wrought iron, and steel, made at the most important works in Great Britain. During the experiments, the metals were exposed at two several periods of 387 days, and of 732 days respectively, to the action of—

1. Clear sea water, at temp. 56° to 58° Fahrenheit.
2. Foul sea water „ ditto.
3. Clear sea water „ 110 to 125 ditto.
4. Clear river water „ 32 to 68 ditto.
5. Foul river water „ 36 to 61 ditto.
6. Freely exposed to the atmosphere, and its precipitations, at Dublin.

Tables are also given containing the amounts of corrosion of cast and wrought iron, in sea and fresh water.

1. When coated with zinc, or galvanically protected by its contact.
2. When painted and varnished in various ways.
3. When in contact with various definite alloys of copper and zinc, and of copper and tin, as in brass and gun metal, which are both electro-negative to iron in water.
4. Of cast iron, with the surface variously modified by the method of coating, as by chilling, &c., or with the surface or coat removed by planing.
5. Of the specific gravities, rigidly ascertained, of all the specimens of cast and wrought iron and steel, experimented on, and determinations, for the first time made, of the changes in density, produced by casting iron under a variable head of metal, and of the effects on density of changes in the mass or bulk of castings in iron; all which, the author has shown, affect the ratio of corrosion of a given sort of cast iron.

These tables, which the author intends to contain the chief information requisite for the engineer, to enable him in practice to allow for the loss of his structures by corrosion in any given time, and to choose the most desirable irons, &c., are followed by others, which condense into one view the whole results arrived at, and fit them for practical reference.[2]

Another principal object held in view in the tabulation of these results, and effected by the author, was by discussion of their contents to discover upon what variations in the texture, density or chemical constitutions of the metal, maximum and minimum corrodibility under given conditions depended; for this purpose numerous exact analyses of the cast and wrought iron, &c., of maxima and minima corrosion, became requisite. These have been made by the author, and are given in separate tables, together with the details of the methods adopted for obtaining correct results; a matter of admitted difficulty in the case of the analysis of iron.[3] These analyses show that corrodibility does not depend upon the proportion of constituent carbon in cast iron, and still less upon that of the other foreign matters usually found in it; but upon the state in which carbon exists in the compound; upon the state of aggregation of the whole mass; upon the density, and upon the voltaic uniformity, or otherwise, of the surfaces exposed to corrosion. Thus the same sort of cast iron corrodes much faster, in given conditions, if cooled irregularly, and faster than it does when cooled uniformly and slowly.

Hot or cold blast produces very little difference in corrodibility of cast iron, and this results chiefly from difference in density; recollecting that carbon exists in cast iron in two very different states, viz., as diffused graphite in a crystallized form, and as combined carbon; that the dark grey and softer irons contain more of the former, while the harder and brighter irons have more of the latter; that the latter kind have much less uniformity of surface, when cast under similar conditions, than the former; while the highly graphitic irons, though more uniform in large specimens, are the least dense and softest in texture—we arrive hence at the ultimate choice that the bright grey irons of high commercial value, while they are in all, other respects the most useful for construction, are also the most durable when exposed to the action of air and water. The second prolonged period of immersion of all the specimens was necessary, in order to determine the "law of progression of corrosion, with respect to time." The author finds that where the coat of oxyde and of carbonaceous matter or plumbago formed, is constantly removed from the surface of cast iron exposed to corrosion in air and water, the progression of the latter is a decreasing one, because as the metal is removed, the inner portions become more uniform in texture, and fewer minute voltaic couples are formed; but where the oxydes and plumbago remain untouched, these being both electro-negative to the metal, nearly equilibriate the effect of the regular texture; and thus the rate of corrosion remains uniform, or is nearly in direct proportion to the time of reaction. This is demonstrated experimentally, and is most forcibly exhibited in corrosion by sea water. Hence in practice, cast iron immersed without any protection, will corrode less if occasionally scraped and cleaned; or if in a tide-way, than if untouched and in still sea water.

The rate of corrosion, as dependent on the metal itself, is a minimum when the cast iron is most uniform and hard, and free from suspended graphite, and as dependent upon the water in which it is immersed; is a maximum in foul sea water, and a minimum in clear river water, both being at mean temperature, and containing nearly the same volumes of combined air and carbonic acid. The kyanized oak boxes, 2 in. in thickness, in which the specimens were immersed in Kingston Harbour, were eaten through in about two years by the *limnoria terebrans*. Cast iron freely exposed to the weather at Dublin, and to all its atmospheric precipitations, was corroded nearly as fast as if in clear sea water, when the specimens in both cases were wholly unprotected.

The results of experiments on wrought iron and steel, show that they consist of two or more different chemical compounds, coherent and interlaced, of which one is electro-negative to the other. The electro-positive body being that which suffers first from corrosion, the electro-negative portions of the iron and steel remain bright, and hold a perfect metallic lustre until the whole of the other portions are removed, or at least are so to a great depth, when they begin likewise to oxydate. In general the finer the quality of wrought iron, and the more perfectly uniform its texture, the slower and more uniform is its corrosion in water; minute differences in chemical constitution produce little change in this respect. Highly silicious wrought iron, however, corrodes very locally, and appears to be partially defended by a thin coat of silex formed on it. Fagoted scrap bars, made from best Staffordshire rivet iron, was found of all the irons experimented upon, to be the most durable; next to this was Low Moor boiler plate, and it is thence preferable for iron ship building. Foul sea water, evolving sulphuretted hydrogen, gives the maximum corrosion of wrought iron and steel. The contact of soft putrifying mud appears to be still more destructive. Steel generally corrodes more uniformly and slowly than wrought iron. Hardened

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[2] These tables are not susceptible of abstract, but they are being prepared for publication in the forthcoming volume of the Transactions of the Institution of Civil Engineers.

[3] The author thus describes the mode of analysis practised by him:—"The method adopted by me, in most cases, was a modification of Regnault's process, which consisted in mixing the cast iron, finely pulverized, with about twelve times its weight of chromate of lead properly prepared, and mixed with a little chlorate of potash. This is burnt in an ordinary combustion tube, in the remote extremity of which some dry powdered chlorate of potash is placed, and heated after the combustion has been completed, so as to pass a current of oxygen over the ignited mass. This precaution is indispensable with the harder and denser irons, containing most of their carbon in combination. The total amount of constituent carbon is thus obtained, and weighed as carbonic acid: but this consists of graphite and of combined carbon. By a separate assay, the graphite is obtained, on solution of a weighed portion of the metal in nitric acid, as residue, consisting of graphite, extractive matter (from the carbon of combination) and silica, and occasionally some oxydes of combined metals. The residue is filtered and washed, boiled in caustic potash, by which the silex and extraction are taken up. The graphite remains: it is again washed with dilute muriatic acid, then with water, and weighed after drying. The difference between this and the total amount of carbon given by the combustion is equal to the carbon of combination.

"For the other constituents, after a preliminary qualitative trial, about 120 grains of the cast iron were dissolved in nitric acid, evaporated to dryness with a strong heat, and ignited in a platina crucible with three and a-half times its weight of carbonate of soda. After cooling, water is poured over it, which carries off the excess of alkali and an alkaline phosphate or sulphate, if the iron contained sulphur, which should be ascertained beforehand, leaving the peroxide of iron to be separated by filtration. The filtered liquor must now be boiled for some time to destroy the manganesiate of potash in solution, and precipitate the manganese; again filtered, nitric acid added, evaporated to dryness, and silicic acid separated, if any exist, on heating with water, after moistening with acid in the usual way. Ammonia is now cautiously added, and if the iron contained aluminum, a basic phosphate of alumina precipitates. The solution, again filtered, is acidulated with acetic, and the phosphoric acid precipitated by acetate of lead. From the phosphate the phosphoric acid cannot be estimated with certainty; it was therefore converted into sulphate of lead, and the phosphoric acid got from its weight.

"The silex and manganese were always obtained by precipitation from the iron, &c., in separate assays; the method with benzoate, or succinate of ammonia, though inconvenient, is one of the best where the amount of iron is considerable. Leibig's process of separation, by boiling with carbonate of barytes, succeeds very well, and presents no difficulties; but when the amount of manganese is so very small in proportion to the iron, I preferred the former mode. The iron itself, from its inconvenient bulk, was generally estimated from the other constituents. Separate assays are also best made for sulphur or earthy bases: but as far as my observation goes, these are extremely rare in British cast-iron.

cast steel, after "tilting," has the average minimum corrosion, and low shear steel, which is in fact a sort of steely iron, has the maximum.

The author has made researches on the nature of the peculiar carbonaceous substance which he has called "plumbago," formed by the decomposition of cast iron in sea water, and in other conditions, and also occasionally from wrought iron and steel, and on the other organic products of such decompositions. His reasonings tend to show, that this plumbago in part results from the decomposition of carbonic acid in solution in the water, and is therefore highly interesting to the chemist, as an instance of crystallized carbon being so formed. The rust produced by the prolonged action of air and water on iron, is brown hæmatite; and omitting all minute or accidental constituents of the iron, its formula is $2 Fe^2 O^3 + 3 HO$, more or less mixed with spathic iron ore – $Fe O \times CO^2$. When very old, these lose water, and become "fer oligiste," or anhydrous peroxide. The author then discusses the conditions most and least favourable to corrosion in marine steam-boilers, with reference to the degree of saline concentration, boiling temperature, &c., of the sea water; and gives tables of the saline contents at various stages of concentration. Sea water, to act least on boilers, should be heated to 1°0 Fahrenheit, and be deprived of air before entering as feed water, and the less concentration takes place, the less will be the amount of corrosion. The tables of the amounts of corrosion of cast iron, in contact with definite alloys of copper with tin and zinc, are now extended to wrought iron. The corrosion of this is accelerated by the contact of either brass or gun-metal in sea water, but more so by the latter than by copper. He confirms his previous results that, except in atmospheric air, a coating of zinc, or contact of zinc in a massive form, affords to cast or wrought iron only partial protection from corrosion.

In foul sea water, the zincing is converted into artificial blende = (Zn + Fe + S). Elkington and Ruolz's zincing process he finds capable of many useful applications for iron exposed to air, but he questions its efficacy in water, or where there is abrasion. Zink paint he states to have been found the most durable of all the paints and varnishes tried, except coal-tar laid on hot, and the asphaltic varnishes. The author then enters largely into many questions relative to the corrosion and fouling of iron ships, applying to them the laws he had previously deduced. Based on the known effects of a slightly alkaline solution in preventing corrosion, he proposes lime-water to replace bilge-water, and thus to prevent internal corrosion in iron ships. He describes his prolonged experiments on the means of preventing their external corrosion and fouling, and the details of his methods of preventing both. These consist in coating the plates with an alloy of zinc with mercury, and a very minute portion of the base of either of the alkalies. The coating is effected by peculiar methods to ensure perfect uniformity; and the principle of protection is, that the alloy produces by the first action of a menstruum, a surface of amalgamated zinc which is insoluble. This coating is protected by an asphaltic varnish, to prevent the contact of the slightly soluble poisonous paint, with which the ship's hull is payed over to prevent fouling. Several metallic salts are fitted to act as poisons to the molluscous and testaceous animals which infest ships' bottoms; but the author's experience leads him to prefer oxychloride of copper, which is, in fact, the salt formed on common copper sheathing, and which by its poisonous qualities keeps it clean.

The author's method has been in use for some time on vessels which have made voyages to the tropics, and its usefulness in preventing fouling, &c., has been fully proved. He discusses and explains the errors which have been made as to the non-corrosion of ships kept in motion, and shows that corrosion does take place, but that it is not so perceptible as when the ship remains at rest. He shows that magnetism has nothing whatever to do with the amount of corrosion in iron vessels, and also discusses at length, various contingent circumstances promoting partial corrosion in iron ships: the nature of cargo, the mode of fastening the machinery, the contact of boilers, of various timbers, and of the same when decayed, &c.; all of which are of practical importance to the iron ship-builder or marine engineer. Kyanized timber is rapidly destructive of iron, in contact with it; in sea water it more than doubles the rate of its corrosion. After giving a table containing the numerical values, for iron ship-building, of a number of qualities of British wrought iron, the author proceeds to discuss in detail the principal methods of protection for iron, which have been recently promulgated by Berry, Neilson, Shore, Elkington and Roulz, Hall of Bermondsey, Crawford and Fountain-Moreau, all of which are patented; but none of them, except that of Elkington and Ruolz, &c, he contends, proved to be of practical value in the conditions above mentioned.

Lastly, he states that as uniform corrosion cannot be ensured in the case of iron ships, and as local action is liable to produce fatal accidents at unlooked-for moments, protection from corrosion and fouling, must be considered essential to the safety of iron ships; if so protected, the author contends that they are safer in every respect than the best vessels constructed of timber. He also gives instances from various authorities of the rapidity with which foulness accumulates on ships' bottoms, even of wood, and more so if of iron, and dissents as to the possibility of removing the fouling of iron ships by any scraping process, unless performed in the dry dock, and constantly repeated.

The communication concludes with some observations, as to the presumed differences in the rate of corrosion, between railway bars in use and out of use, or traversed in one or in both directions. Upon this subject the author has experiments in progress on several railways, and expects at a future time to lay the results, as to the amounts of loss by corrosion and abrasion, before the Institution; at present his belief is that railway bars, being otherwise in the same condition, corrode alike, whether travelled over or not.

Remarks.—Dr. Ure said that the part of Mr. Mallet's paper which was most interesting to chemists, was the mode of analysis. This was always a subject of delicacy, difficulty, and labour. His own mode of analyzing cast-iron was somewhat analogous to that which had been described. He took a portion of iron, reduced by filing to a fine powder, mixed it with the same quantity of chlorate of potash, and five or six times its weight of clean siliceous sand, to dilute the mixture: this was heated in the usual way, in a combustion tube with more chlorate of potash, whereby all the carbon contained in the iron was converted into carbonic acid, which was passed through a solution of the sub-acetate of lead, instead of potash water. Carbonate of lead was thus produced, and its amount, when washed and dried, gave the quantity of carbon in the iron operated upon, 131 parts of carbonate of lead, indicating 6 parts of carbon; therefore $\frac{1}{100}$th of a grain of carbon might be detected by this method. The question as to the state in which the carbon existed in the iron was more difficult of solution. Karsten's mode of determining this point was very delicate and accurate: the pulverized iron was mixed with moistened chloride of silver, which acted upon the metallic iron alone, leaving the carburet of iron untouched, and its amount could thus be determined with great nicety. With white iron which could not be filed, the chloride of silver was formed into a mass. A disc of it being placed at the bottom of a vessel with a little water over it, the piece of iron was laid upon it; a few drops of muriatic acid were then added, and in eight or ten days the iron was dissolved, leaving untouched the carbon, which existed in the form of graphite.

Mr. Williams agreed in the advantage of preventing the corrosion of iron vessels, but he feared the expense of the mode proposed by Mr. Mallet, particularly as at present, although comparatively unprotected, they were very durable. He instanced particularly the light boats on the river Shannon, which, although constructed of very thin iron, and had been at work between six and seven years, exhibited no signs of decay.

Mr. Rendel said that the durability of iron canal boats was well known. On the Tavistock canal, there now existed some boats which had been employed for 25 years in carrying coals, iron, and copper ores, or other goods, and yet they were not extensively corroded.

Mr. Field stated, that although in India iron generally corroded rapidly, the iron vessels that had been sent there, did not appear to be affected sooner than in England. He had been informed by Mr. Laird, that the boilers of the *Garry Owen* iron steamer, had been renewed twice in nine years, and on every occasion it had been remarked, that although the bottoms of the boilers were entirely destroyed, the iron plates of the hull of the vessel immediately beneath them retained their original coat of paint, and were not at all corroded.

Mr. Jordan suggested the probability of the hull of the vessel being protected at the expense of the boilers, on account of the electric character of the metal being altered by the heat of the boiler, and the general circumstances induced.

Mr. Field said that the boilers in question had lasted as long as they would have done on board a timber-built vessel.

Mr. Williams corroborated the statement. The boilers had worn out in the regular time, and had failed first in the usual spot, which was the bent plate, where the sides joined the bottom. There was not any thing remarkable in the wear of the boilers.

Dr. Ure thought that the heat of the boilers having probably been sufficient to dry up any moisture from beneath them, might have tended to preserve the hull of the vessel from corrosion in that spot. It was easy to account for a less degree of corrosion taking place in iron ships, or on rails of railways, as long as the former were constantly kept moving, and the latter were regularly travelled over. In these cases any oxydation which took place was rubbed off as it was formed; but if either were in a state of inactivity, the scale of rust permitted an accumulation of moisture beneath it, an active galvanic pile was completed, and oxydation went on with increased rapidity.

Mr. Vignoles remarked that the paper did not notice the iron water-tight bulk-heads for vessels, which had been introduced by Mr. C. W. Williams. Their practical utility was now generally admitted, and he believed they were about to be adopted in the navy.

Mr. Williams said that about nine years since, he first introduced the system of dividing the hull into five compartments, by four water-tight iron bulk-heads, with the intention of their adding to the strength of wooden vessels; but it occurred to him that they would be otherwise useful, and although the ship builders opposed it, he persevered, and now all the vessels under his superintendence had them. Their value had been proved on many occasions, and by them, the *Royal William* and several other vessels had been saved. With four bulk-heads it was impossible for a vessel to sink, unless three of the compartments were broken into, which was scarcely possible.

The President believed that the *James Watt*, which was built at least 16

years since, had three close timber bulk-heads, intended for the same purpose as the iron ones.

Mr. Williams replied that they would not answer the same purpose as the iron ones, and that if a vessel had only three bulk-heads, making four compartments, if one of them was broken into, the vessel would sink, but with five compartments it would be saved. With regard to the general durability of iron vessels, he recollected an iron vessel being built at the Horseley iron-works more than 20 years since, which he believed was still in existence; and a small boat, built for him by Mr. Grantham, of very thin plates in the year 1824, was still at work.

The Secretary stated that the vessel alluded to by Mr. Williams, was the *Aaron Manby*, which was built by, and named after his father in the year 1821. It was the first iron vessel that ever went to sea; it had been very roughly used, and the engines and boilers had been more than once renewed; yet the hull had scarcely required any repairs. and it was very slightly corroded, although it had been severely tried by being used in both fresh and salt water upon the river Seine, for which service it was built.[4] It was well known in Staffordshire, that many iron canal boats which were used indiscriminately for carrying coals, iron ore, limestone and other cargoes, and had received scarcely ordinary attention, were upwards of 40 years old, and were still serviceable.[5]

Mr. Braithwaite said that he had recently heard of the sale of a wooden vessel 45 years old, which was still sea-worthy, and was capable of being insured.

The President observed, that although part of two evenings had been devoted to Mr. Mallet's paper, yet that such was its value, that it could scarcely be discussed until members could pursue it at leisure, and enter into the wide field of observation which it embraced: it was a paper of undoubted merit, and the attention of the Publication Committee had been directed to it by the Council, in order to its general circulation, with the former valuable paper, by the same author, as soon as was practicable.

Electro-Magnetic Telegraphs.

A pair of electro-magnetic signal telegraphs, constructed for the Aix-la-Chapelle railway, from the plans of Professor Wheatstone, were exhibited.

Professor Wheatstone explained, that the principle of this signal telegraph, which he considered to be the most efficient arrangement for practical purposes, was the same as his last electro-magnetic telegraph, in which a dial, or hand, was caused to advance by the alternate attractions and cessations of attraction of an electro-magnet, occasioned by corresponding alternate completions and interruptions of the circuit, by means of a peculiarly constructed apparatus, placed at the opposite end of the telegraphic line. The present signal telegraph was intended for the use of the inclined plane on the railway at Aix-la-Chapelle, where only a limited number of signals were required; the entire alphabet of the complete telegraph, was therefore dispensed with, and the instrument was restricted to six elementary signals. The letters M, S, C, T, B, &c., on the face of the dials were the initials of the German words for engine, rope, train, telegraph, &c. The dial was eight inches in diameter, and the characters were conspicuous, so that they might be readily seen at a distance; the hand, which was required to be made very light, and to keep its form, was of blackened mica. The cross being reserved to indicate the quiescent condition of the apparatus, there remained five available characters, which, combined two and two, gave 25 signals—a number amply sufficient for the purposes of the railway. It being established as an invariable rule, that each signal should consist of two characters followed by the cross; were the telegraph to act in any way irregularly, the index would, at the end, point to some other character, instead of the cross, and this would indicate that the preceding signals were wrong, so that if the signals received, should not correspond with those sent (which, however, could not be the case if ordinary care was taken), no mistake could possibly arise, because they carried with them the evidence of their error. The instruments were furnished with a simple means of bringing the hand immediately to the resting point, without interfering with the circuit. As it might be occasionally required to transmit a permanent signal, which should remain, until a person arrived to inspect it, the five simple characters could be employed for this purpose.

[4] "Iron as a Material for Ship-building," by J. Grantham, 8vo., London, 1842, p. 6.

[5] In a letter from Mr. John Laird, dated June 29, 1843, he says, respecting the probability of corrosion in iron vessels, "I beg to state that the following vessels have had their boilers replaced (some of them twice), and that the bottom and sides of the vessels near the boilers have been found quite free from corrosion; in fact, the paint originally put on was almost perfect:—

Lady Lansdowne, built in	1833
Garry Owen	1834
Eliza Price	1836
Duncannon	1836
Duchess of Lancaster	1839

"The *Euphrates* steamer, built in 1834, has had her machinery taken out, and been converted into an accommodation boat for passengers for the Indus. The hull of the vessel was found quite perfect, free from corrosion, and as perfect and sound as the day she was launched."—Sec. Inst. C. E.

The instruments at each station consisted of a telegraph, an alarm, and a communicator; they would be arranged in the circuit, in several ways to suit particular purposes, but no other alteration was requisite to effect this, than a change in the disposition of the terminal wires, and of their connexions with the communicators. The telegraphs might be so placed, that they would act simultaneously, when either of the communicators was worked, or they might be so arranged that the instrument at one station, should only be acted upon by the communication at the other, which, in many cases, was preferable, as a great resistance was thereby taken out of the circuit. Other arrangements, useful under particular circumstances, were also practicable. This telegraph, even when all the letters of the alphabet were employed, required only a single circuit of communications between the two stations. Professor Wheatstone's former permutating magnetic needle telegraph, though possessing a power of combination far exceeding that of any preceding telegraph, in which magnetic needles were proposed to be employed, required a number of wires proportionate to the number of signals.

By employing the earth, or an extent of water, to return the current, or complete the circuit—which might be done, by connecting the two extremities of one of the communicating wires with plates of metal, and plunging them into the earth or into water—one of the communicating wires might be entirely dispensed with; this plan would be adopted at Aix-la-Chapelle. That a large extent of earth, or a portion of a river, could be made to complete an electric circuit, was long since established with respect to electricity of high tension, by the extensive experiments of Dr. Watson, in 1748, and others; and the same thing was proved with regard to voltaic electricity, by the independent experiments of Erman, Basse, and Aldini, made in 1803. Erman's experiments were performed in the river Havel, near Potsdam; those of Basse in the river Weser, and the environs of Hamel; and Aldini's researches were prosecuted on the shore near Calais. Professor Steinheil also employed the earth as a means of completing the circuit, in the electro-magnetic telegraph which he established at Munich in 1838.

A pair of Professor Wheatstone's telegraphs were established at Berlin in the beginning of 1842: the line of communication was a single wire, carried through the air upon wooden posts, and plates of metal attached to the ends of the wire were buried in the ground. In the same year he formed a communication between King's College and the shot tower on the opposite side of the river: the communicating wire was laid along the parapets of Somerset-house and Waterloo-bridge, and thence to the top of the tower, where one of the telegraphs was placed; the wire then descended, and a plate of zinc attached to its extremity was plunged into the mud of the river; a similar plate was attached to the extremity at the north side, and was immersed in the water. The circuit was thus completed by the entire breadth of the Thames, and the telegraphs acted as well as if the circuit was entirely metallic. The peculiar construction of the present signal telegraph, enabled a magneto-electric machine to be substituted for a voltaic battery. This source of electric action not being subject to cessation or diminution, the attention necessary for keeping a voltaic battery in order, was dispensed with, and the instruments were always ready for action, without any previous preparation.

ON FRESCO PAINTING.

Abridgment of Mr. Charles H. Wilson's Report to the Commissioners of the Fine Arts.[1]

Mr. Wilson in this report first describes and considers the construction of the walls on which frescos and other mural paintings are executed, and then proceeds in order with the other portions of his subject.

Mural paintings were executed upon plaster of various kinds, laid upon walls variously constructed; several examples also occur of frescos which were painted upon plaster laid on lathing. The comparative durability of works executed under these circumstances Mr. Wilson explains by several examples, on the Continent. They are found on three kinds of wall:—ashlar walls of Gothic edifices—brick walls of buildings of different dates—and upon coarsely built rubble walls of different kinds. To these are to be added frescos on lath, of which there are many examples in different parts of Italy. From the observations which have been made by Mr. Wilson, it appears that plaster will not stand well upon ashlar walls, unless the stones be small and the seams open; for if the plaster be loosened from this kind of wall by damp or accident, it entirely falls away in large masses, showing that it does not adhere firmly to the masonry. Brick walls are the best for fresco, and the practice of the careful Germans and modern Italians are in favour of this opinion.

There are many specimens of frescos *upon lath* in Italy; the most ancient is that of the "Trionfo della Morte," by Orgagna, in the Campo Santo of Pisa. The artist probably adopted the precaution from having entertained

[1] C. H. Wilson, Esq., Director of the Government School of Design at Somerset House, was, in the course of the last year, employed by Her Majesty's Commissioners on the Fine Arts to proceed to the Continent to collect information relating to the objects of the Commission. Having been furnished with the necessary instructions he left England in August and returned in January last.

doubts as to the fitness of the walls of this edifice to receive frescos. The ceiling frescos in the upper Loggia of the Vatican by Giovanni da Udine are upon stoja or lath: the wooden framing to which the lath is attached is executed with a rudeness that would seem almost incredible, and these works have suffered severely from the original defective carpentry and from neglect and damp. (See Figs. 1 & 2.)

Fig. 1.

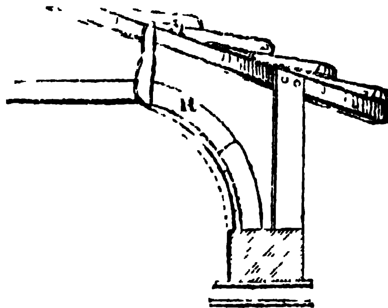
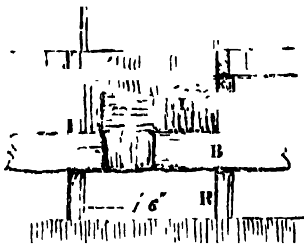


Fig. 2.



L. Lathing or Stoja.
B. Boarding.
R. Ribs.

From various instances quoted in the Report it appears that frescos may safely be executed upon lath.

The Mortar.—It is not possible to make many observations on the mortar on which mural pictures of the period before referred to are executed, as, fortunately, there are not a great number which are in such a state of dilapidation as to permit a particular examination of them in this respect. The majority of these pictures are painted, as is well known, upon an intonaco composed of lime and sand. It is evident that there was a diversity of opinion with regard to the quantity of sand to lime to be used, and the same diversity of opinion exists amongst the modern *frescanti.* From such examination as it was possible to make, it appears certain that those frescos have stood best in which it is apparent that there is a considerable proportion of sand in the lime; and I am disposed partly to attribute the bad state of the frescos by Correggio in the Duomo of Parma to his having used what is called a rich intonaco (that is, with a small proportion of sand), and the faintness of the colours is perhaps to be attributed to the same cause.

A number of mural paintings are executed upon an intonaco formed of lime and marble dust; these however are not frescos but distemper pictures; that is, pictures which, although in many instances commenced in fresco, yet were finished in distemper. Pictures of this description are also found upon intonacos of lime and sand; and if at first the practice may have arisen from necessity, it appears to have been continued afterwards from choice, even after complete works in pure fresco had been executed.

There is nothing to be learnt apparently from old Italian plastering. In point of execution, it is surprising that such careless work could ever satisfy the artists. The Venetians have shown themselves in many instances clumsy plasterers beyond all others; the works of Pordenone especially exhibit the rudest workmanship, the surface being very uneven, and the joinings of the intonaco which mark the different day's work being very carelessly executed: such is also the case in the frescos of Titian. The Florentine practice is better, but still far from presenting, in many of the early examples, sufficient attention to the preparation of the surface. If the wall was even, the plaster was made even, but if the wall was altogether the reverse, the plaster was allowed to be so also, and it is only in the works of later masters that we find this workmanship so attended to as to secure an even surface: the frescos of Allori in S. Lorenzo and in the Palazzo Vecchio are models in this respect.

In the Baths of Titus examples will be found of—first lime and coarse sand, half an inch thick; then lime and pozzolana, of one inch in thickness, in which, however, there is an admixture of sand and pounded brick; the last and upper coat is of lime and pounded marble. It will be found that this, as regards the two last coats, is the identical preparation which is so commonly used in Italy for floors under the name of Venetian pavement, except that in the latter the fragments of brick in the substratum and the fragments of marble in the superstratum are much larger. It is also quite plain, from the size of the fragments of marble in the specimens of ancient plaster, both in the Baths of Titus and at Pompeii, that the wall could not possibly be brought to a smooth surface either with the trowel or float; it must have been allowed to dry, and was then polished. It follows that in walls of this description the red, yellow, and other tints with which it was painted must have been subsequently applied, and had nothing of the nature of fresco, an art which, however, is apparently exemplified in ancient examples, for instance, in the Nozze Aldobrandini.

It may be generally stated, without adducing other examples of this period, that where the plastering is uneven, the ruin of the fresco, or its serious injury, is the result, whilst those frescos which have smooth and even surfaces will be found to be generally in good condition; and the most perfect specimens in point of workmanship and preservation are the frescos of the Caracci and of their scholars. These, in the majority of instances, are quite perfect, and may be quoted as triumphant specimens of the durability of this mode of painting.

The Execution of the Picture.—We find that whilst several mechanical modes of outlining (first Report) were adopted for fresco, each artist used these means in his own peculiar way, little influenced apparently by any received rule; and as every artist commonly adheres to his own method, the execution of the outline may assist in deciding on the authorship of a work of art.

The practice of *indenting the plaster* with a point or stylus is very ancient, and we find that the figures painted in Etruscan tombs were thus outlined, that is, the point was used to mark the external outline of the figure only. It was employed by the early masters at the revival of art in Italy precisely in the same way in outlining their works in distemper on panel; thus Giotto drew, and his followers; and we find the same practice follow in the Sienese school, with a singular exception, which is, that the figure of the Madonna is entirely marked in with the stylus, that is, not merely the external outline, but the outlines of folds in the drapery are drawn in in the same manner; and a notice of this practice, confined to the school of Siena, is useful, as it establishes a clear distinction between the early pictures of that school and those of the contemporary Florentine masters. It has been supposed by some that these outlines were intended as a guide to the plasterer in spreading the intonaco, but in no case do the joinings in the plaster coincide with them. If we suppose that the composition was thus sketched in to enable the artist to judge of the proper proportions and positions of the figures, what then was the use of his cartoon in this respect? it would have been more easy to place it against the wall, as is now frequently done.

Another mode of outlining, that is by *pouncing*, was extensively adopted; this method, as well as the last-mentioned, of course implies the preparation of a large cartoon; and there was still another mode, or rather union of the modes above alluded to, viz. the outline was first pounced and then, the cartoon being removed, the forms were retraced with the stylus; this is the practice of the modern Italians, and although imposing names may be quoted in support of it, an uncertain and feeble outline is the result, and besides, in sudden turns it breaks out bits of the plaster, leaving unsightly holes in the picture.

Painting.—In studying the art of fresco-painting, it is necessary to consult the works of the old masters for examples of execution. In everything that is merely mechanical, we may profitably study the proceedings of the modern Germans; every process may be learnt from their practice, without visiting Italy, the graceful use of the brush excepted. Amongst the works of the present Italian fresco-painters, there is perhaps no example which it would be desirable to follow. The execution of these artists is to the last degree mannered and heavy, and however satisfactory may have been the progress of the French in other modes of painting, they have entirely failed in the few attempts which they have made in fresco.

Avoiding the errors into which we may conceive that our continental brethren have fallen in the actual painting of their frescos, we must look to the works of the old masters as examples; in these we shall find painting in fresco, in as many styles, and exhibiting as much diversity of touch and handling, as may be observed in the works of the same artists in oil. There is the same liberty of thought in the treatment of both methods, and genius exhibits its powers with as endless a diversity in the one art as in the other.

We find in the frescos of the old masters every quality of execution that has a name in oil-painting, although those qualities are necessarily exemplified in different degrees; we have transparency, opacity, richness; we have thin and thick painting, nay loading, and that to an extent that cannot be contemplated in oil. We have the calm transparent elegant painting of the Florentines and Romans, the rich variety of the Venetians, and there are cases in which the well-nourished brush of Rembrandt seems represented in the works of the fresco-painters of old Italian times.

The distemper paintings of the elder masters have already been alluded to; it was their practice in laying in the preparatory tints in fresco, to make some of these totally different from the colour to be used in finishing in distemper: thus, a dark red colour was almost invariably laid in as a preparation for blue, and this practice was generally adhered to with very few exceptions till after the time of Raphael. In the works of Giotto, in the Campo Santo, at Pisa, the plaster seems to have been painted black in the first instance. Time did not permit a satisfactory examination of these

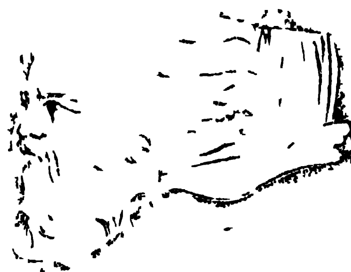
works, but there is an example of the use of black as a preparation for blue in the Farnesina where Daniele da Volterra in his frescos on a ceiling in that edifice has first laid in a coat of black in fresco, and then a coat of blue in distemper. In some pictures, as for instance in those by Andrea Mantegna in the Eremitani at Padua, the blue of the skies has either partially changed or entirely faded, whilst that of the draperies is comparatively well preserved, it is thus evident that from motives of economy different blues were used in different portions of pictures. There are many other examples of this in other parts of Italy.

The Cardinal Bonaventura, in the fresco called the Dispute of the Sacrament, by Raphael, is represented in a purplish black robe which has been painted over red; this is an instance of the adoption of an indirect process with reference to another colour besides blue. It may be observed that the cardinal was a Franciscan, an order which is distinguished by a brown dress, and, as it is not brown in the picture, this may perhaps be an instance of a change of colour; but one object of this mode of painting seems to have been the security of the colours against change, while another may have been the attainment of more harmony in the tone. In the picture just mentioned, Raphael has followed precept in painting the blues in distemper over red, and these have stood perfectly. In the School of Athens on the contrary, he has painted in the blues in fresco, and they have perished or nearly so, as they have been in most instances in every part of Italy where blue has been thus used, both in pictures of this and of previous times. In the great works which Raphael subsequently painted in the Stanze, he returned to the old practice of painting the blues above red, probably dissatisfied with the crudeness which was the result of using them on the wet plaster. The blue that has thus been generally used seems to have been of a vegetable nature, as in many instances it has changed to a brilliant green. It may be urged that the use of ultramarine or cobalt may obviate all necessity for such preparations, and secure the pictures against change; but whilst the former is by far too expensive a colour, the latter is crude and harsh in fresco. It seems to have been the blue which was used by the Caracci and in their pictures, as in those of Guido, it will be found to be frequently out of harmony with the other colours, either these have in some degree faded, the blue remaining the same, or the blue has increased in intensity. Domenichino used distemper extensively in his works; but in those of Guercino will be found a triumphant solution of the difficulty; his blues are put in in fresco, and yet are in fine harmony with the other tones; they have generally a warm purple hue, and may be either smalt, or cobalt tempered with red such as colcothar of vitriol. This is strongly exemplified in the Zampieri Palace at Bologna, where the harmony apparent in a fresco of Guercino is an agreeable relief, after the crudity which offends in those of his masters in other rooms of the same palace. A comparison between the Aurora of Guido in the Rospigliosi at Rome (all the blues in which are not retouched) and that by Guercino in the Ludovisi, further corroborates the above observations.

As has frequently been stated in the previous report, it was the practice to retouch when the fresco was dry, more especially in the shadows. In some cases it is now easy to detect this retouching; it will generally be found to be proportionably somewhat darker than the painting around, and whilst in many frescos a remarkable polish or gloss may be observed, even in situations where that effect could not be produced by rubbing, the retouched parts are invariably dim. This is exemplified in the Evangelists by Domenichino in the church of S. Andrea della Valle at Rome; they are historically known to have been retouched, and in viewing them from particular points their surfaces are seen to shine as if varnished, whilst some parts which it may reasonably be inferred are retouches, such as darks under the arms and in the deep folds of the drapery, are quite flat and dim.

There are portions in Raphael's pictures which present the appearance just described; in the School of Athens there are a few distemper touches evidently by the master's own hand, which have darkened; for instance, in one head he has had recourse to distemper to represent the external locks of hair. This seems to indicate a difficulty in fresco which at first sight appears formidable. In a picture by Gaudenzio Ferrari, at Milan, a female head with long flowing locks is represented, and the joining is made next the locks, and has a very bad effect, the difficulty is successfully overcome by the German artists without having recourse to distemper, and without placing the joining so as to injure the appearance of the picture. This may best be exemplified by a sketch: the flying tresses are painted in on the back ground on one day, and the head is put in the next day, the joining is indicated by the dotted line in the figure (Figs 3 & 4). The foliage of trees is managed in the same way. It would be vain to think of cutting round the outline of foliage, the outer leaves and thin projecting branches are executed on the same day with the back ground and the cutting is kept quite within these.

Fig 4



Wall (except parts of sky) etc two days. The dotted line shows the cutting. The drapery to the le[illegible] executed the same day as the head.

Transparency. This important quality is perfectly attainable in fresco-painting; it is found in the works of the Roman and Florentine masters, amongst the latter more especially in those of Andrea del Sarto, in those of the Lombards it is admirably maintained, and its excess is seen in those of the Venetians.

It is not easy to explain how transparency is to be attained in fresco; there is, perhaps, no quality in which our German brethren are more deficient; the brushes which they use are to an English eye small for the work, and the first tint laid on with these presents a streaky appearance, which perhaps could be obviated in some instances by the use of larger brushes, and a different mode of using them. It will be easily understood how this streaky appearance is produced, having first given one wipe of the brush full of colour, the artist follows it up with another, the colour sinking in instantly, and as he cannot lay the second wipe exactly to the edge of the first, the one overlaps the other in parts, and those parts are consequently twice as dark as the others which have got only one wipe, and so he proceeds laying a tint composed of light and dark streaks, but nevertheless transparent: this quality is lost in uniting the tint for he continues to go over the surface till he obtains what he seeks, a quiet flat tone, which however generally proves a heavy one. Now in the ancient examples, this union is obtained without sacrificing transparency. In a church near Conegliano there are some curious frescos by a Venetian painter, in which the excess of this quality is exhibited; they do not merit the name of works of art, and are very slightly executed, the colours seem laid in in one wash, only the plaster ground shining through; but these bad pictures prove that it is possible to lay in tints in a transparent and yet flat manner.

Titian frequently makes use of the bare intonaco in particular places, thus in his fresco of The Healing of the Foot of the Boy &c, in the Capitolo of St Antonio at Padua, the shadows are laid in with brown in a very transparent manner, and for the half tint he has left the bare lime. It may be doubted whether this practice is to be recommended; it is never found in the frescos of the Florentines or Romans, and that great fresco painter, Luini obtains equal lightness and transparency without having recourse to it. Such a practice gives a work a sketchy character which is objectionable, especially in the principal figures.

How the effect of transparency is to be mechanically obtained it remains for the artist to discover by practice.

A Milanese professor says that with a view to transparency it is necessary to lay in the first tints early in the morning, and then to leave the work and not resume it for two hours. He further says that the lime, if it have any remains of an injurious caustic quality, exhausts its fury, to use his own words on these first colours, and may be more safely painted on afterwards. It must be confessed that the frescos by Appiani, which he instanced as examples of the practice, are very far from exhibiting the quality of transparency. Other artists, however, hold the same opinion, and it is therefore proper to state it.

Hatching.—The prevalence of the practice amongst many of the old masters (for it is evidently not always the result of retouching) seems to prove that they also found a difficulty in getting flat tints; in some of the later masters it is a mere manner, but in earlier and better examples it may have been adopted in the hope of getting a flat tint without destroying transparency; whatever was the reason the practice was very general, and it is to be observed that the great masters did not cross in this hatching; the lines lie all in one way, and Signor Colombo of Rome, says that the tempera hatchings in Michael Angelo's Last Judgment are thus laid on with great evenness and dexterity.

In the works of Raphael, the most perfect of fresco-painters, there is no hatching anywhere, nor is there in those of Correggio. The hatching with

Fig. 3



A, the entire space above the dotted line is painted in one day, and the flowing hair included; the contour being made at the dotted line C. The line B B, represents the joining that less careful artists would have made. C C C, Boundary of another day's work.

which the Cupids of the last named painter in the Convent of St Paolo, at Parma are so excited and destroyed is manifestly the work of another hand, the lunettes underneath have fortunately escaped this profanation

Solid Painting This is a quality that is easily attainable, it will be best understood by observing that whilst the plasterer lays on a preparatory intonaco of lime and sand with the trowel the artist lays on a finishing one of lime and colour with the brush and he may lay it as thickly as he pleases. I observed in the works of Pordenone in Sta Maria in Campagna, at Piacenza that the lights were laid on with such a body of colour that before the lime had time to set, the artist's sleeve or mahl stick, or something else in the way, has accidentally ploughed through his work, which has not been able, or has not ... to mend

Paul Veronese in his frescos in the Villa Mazer, has charged his lights and his imitators in their works both in the above villa and in that of the Olz ... have loaded so much that the lights stand up in lumps upon the wall. Such extravagancies like the washing in of the shadows in the pictures near Correggio ... are poor substitutes for a careful imitation of nature

The lights must of necessity be thicker than the shadows as there is more lime in the colours of the former than in those of the latter. The great masters laid in their colours without ostentatious handling, their works exhibit no tricks of manipulation but it is surprising to observe the manner in which some artists seem to have worked their ... Pordenone has already been alluded to and Polidoro da Caravaggio produces an effect as if his brush had been full of ... as may be seen in his frescos in Rome, viz in St Andrea on Monte Cavallo and in the ...

It is necessary to mention the ... to prove the extraordinary dexterity that has been attained in painting in fresco a dexterity however, which is not to be admired when it produces such effects and which too often distinguishes the pencil of mediocrity

Glazing This process is frequently exemplified in the fresco work of the old masters its most successful application is seen in those of Razzi at Siena where the celebrated picture called the Cristo alla Colonna in the gallery of the Academy is a particularly interesting example of its legitimate application in fresco that is of its use while the plaster is still moist in this instance parts are made out by means of it and much richness and transparency are attained

Pordenone invented or adopted some process which resembles that common in oil painting his works have evidently been glazed after the lime had been allowed to dry the flesh in all his figures is richly glazed the transparent colour filling up the hollows arising from the peculiar loading already described is so remarkably exhibited in his frescos that they can be called such. Polidoro da Caravaggio seems to have adopted some analogous method but probably these are the only masters who can be quoted as having adopted a practice so foreign to fresco painting. Perhaps the artist who painted the papal chair bearers in the Heliodorus may be added to this list. The adoption of such a practice evidently arises from a misapprehension of the legitimate application of fresco painting. It will be found that the Venetian painters generally had no clear idea of the true mode of employing this art even Titian fell into the mistake of trying to produce effects of light and shadow and colours like those which he had been in the habit of producing in his oil pictures. The light and brilliant colouring of Paul Veronese enabled him to paint with more success in fresco than the ... rality of his Venetian brethren, but in his works it is evident that this is merely the result of his system not any attempt at an application of the principles of colour suited to the peculiar art of fresco painting which he sometimes practised, and most successfully at the Villa Mazer. Palma Vecchio alone of the Venetian masters seems to have truly estimated the powers of fresco, there are two saints by him in S ... which have breadth and dignity

Razzi has already been alluded to as an artist whose works most prominently exemplify legitimate glazing in fresco it is not apparent in the works of any other master to the same extent

Time occupied in Painting It is not difficult in examining some frescos to ascertain the time occupied in painting them. In ... the joinings by means of which this calculation can be made are distinctly visible in others they are either so well executed or are so concealed by the use of distemper that it is very difficult to trace them. It is evident that the old masters painted with great rapidity large and important works, judging from the following examples were executed in ... weeks

The "Incendio del Borgo" in the Stanze seems to have been painted in about forty days, the group of the young man carrying his father has been executed in three days. The exquisite group of the Graces in the Farnesina by Raphael, has been painted at most in five days ... and the head of the Grace with her back to the spectator has occupied one day the back and part of the lower limbs of the latter ... another ... this day's work the rest of the leg may have been included. There must be a joining across the knee there was certainly one across the ... both these joinings do not follow outlines but are in parts of the figure which are in shadow. It is of course better as has been already observed to ... outlines, but this is not always possible, especially in very large figures. The Germans prefer cutting across ... light when circumstances compel the artist to make a joining where there is no outline. The graceful composition called the Galatea also in the Farnesina, has been entirely executed in eleven or twelve days the head and bust of the principal figure have been painted in one day. This subject will be further incidentally illustrated

Duration of Frescos —The circumstances which must be taken into consideration in judging of the duration of frescos have already been adverted to. It has been shown that where proper constructive principles have been attended to and where the walls are of good and appropriate material, the ... of the paintings ... are secured and it may be certainly proved that fresco is a very durable mode of painting, not surpassed in this respect by any other if indeed equalled. But independently of the most careful building, various causes may contribute to the deterioration or destruction of frescos, and as these have been very distinctly described in the first Report it is not necessary to say much on the subject further than to state a few facts. Damp is the greatest enemy of this kind of painting, it ascends through the walls from the soil, and descends from ill constructed or dilapidated roofs. In Venice where the houses actually stand in the water the external plastering falls off entirely to a height of twenty feet, ... on wall to a height of from seven to eight feet from the ground. The destruction ... to be attributed to ... still exists under the new leaded one which has ... to save the works of Correggio ... and the inadequate construction of the former is sufficiently apparent in the ...

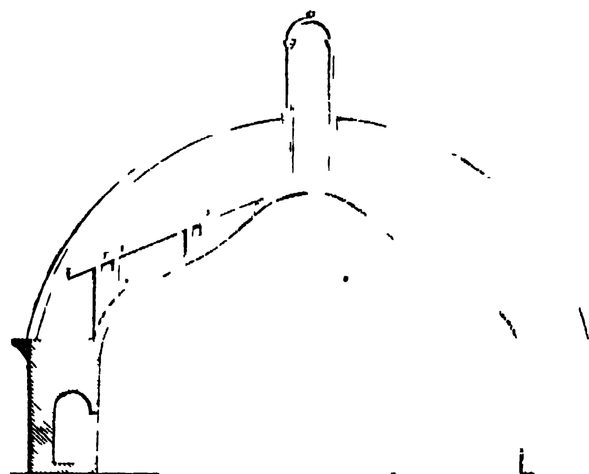


Fig. 5

Duomo, Parma

Many examples might be adduced of injury resulting to frescos from imperfect roofing and the fact having been recognized, precautions have now ... irreparable injury has been done. The tiled roofs of Italy have everywhere been a constant source of injury to frescos, but in some few instances precautions of an extraordinary nature have been taken to make the roof water tight. At the Villa Mazer flat tiles have been laid at right angles to the roof timbers, the joints being filled with lime. These tiles ... the planking under slates in this country and the common roof tiles are put over them in the usual way. This makes an impenetrable ... roof. The plan has lately been adopted in the Palazzo del Giardino at Parma ... frescos there by Annibale Caracci having suffered from damp. The ... have evidently been alive to the necessity of taking precautions against damp, the vault in the Farnese Palace in Rome which is under an open loggia is covered with lead, at the Palazzo del Giardino the upper surface of the vaults has been carefully plastered, but this has not sufficed

Some frescos by Allori, in the Palazzo Vecchio at Florence, which are on a six inch brick wall have lately been destroyed by plastering the back of the wall. In the Library at Siena the paintings on the vaults were ruined by some masons who mixed lime above them. All these facts prove the necessity of preventing by every possible means the passage of damp through the walls, and there is no difficulty whatever in effecting this

External frescos may never be executed in this country, but their preservation in some parts of Italy may encourage their adoption in corridors and porticos. Paintings are found to be well preserved on external walls turned to a favourable weather quarter. Thus as at Genoa and Treviso, although frescos are nearly obliterated by the action of the weather on some walls, it is to be observed that wherever they are protected by the projection of a roof or cornice, they are well preserved. External damp or sea air has no bad effect. The obliteration of external frescos in Venice cannot be attributed to this, since those at Genoa are preserved and those in the Campo Santo at Pisa are doubtlessly destroyed by damp from the soil and roof. As has already been observed, that by Orcagna, in the same place, has not suffered at all from the action of the atmosphere.

The paintings in the upper loggia of the Vatican have suffered severely, owing to the inefficient construction of the roof. Those beneath, from Raphael's designs, have been much obliterated, partly by damp (the corridor

above having been left open till lately, and partly from their having been painted on an intonaco of lime and marble dust, they have also suffered in some measure from violence and mischief.

Effect of Stained Glass on Paintings.—A few facts and observations connected with the employment of stained glass in rooms with paintings in them may not be unimportant, as an opinion has been expressed that windows [illegible] in any degree are incompatible with paintings in rooms so lighted. It rather appears, however, from many instances that stained glass may be [illegible] so employed with great advantage, and that the excess of light may be thus subdued or otherwise modified so as to produce the most [illegible] effect.

In the cathedral at Munich the windows are coloured to a certain height, and although the effect is far from pleasing considered in itself, yet it is very useful as regards the pictures in the church, as the light is brought in from above in an advantageous manner.

At Saronno near Milan there are two small frescos by Luini with a [illegible] window between. The pictures are lighted by a window [illegible] could not be seen at all but for the exclusion of white light by the coloured glass in the centre window. In St Patrizio at Bologna [illegible] an altar-piece under a window filled with richly stained glass, the [illegible] is well lighted from an opposite window, but if the window over it [illegible] of white glass it would have been impossible to see the picture, [illegible] very dark. The sun happened to shine through the rich hues of the window [illegible] and I observed here as I had previously remarked at [illegible] that the picture did not suffer in consequence.

At [illegible] in the upper [illegible] hall the windows, one except over the door, [illegible], but in those which are painted, much of the glass is left white, the light is [illegible] in this church, and it [illegible] is apparent that it does not always answer to tint all the windows, even although pure light is partially [illegible] but where the light is sufficient every window in a room with [illegible] have a certain proportion of stained glass in it, provided pure [illegible] too [illegible] excluded. It may be objected that coloured rays will be thrown on the frescos when the sun shines, but white rays are quite [illegible], and besides frescos never should be placed where the sun can shine upon them as, like other pictures, they fade sooner or later under its influence, coloured glass in such a case might be an advantage, and the inconvenience from the coloured rays would be temporary.

Fresco secco.—Certain processes of painting allied to fresco having been referred to in the foregoing statement, it may be desirable to add a brief account of them.

The early mural pictures, although commenced in fresco, were, as before observed, usually finished in distemper, and the vehicle employed was a mixture of yolk of egg and vinegar. This mode of painting was adopted also [illegible] and on canvass, and it is probable that many Venetian pictures [illegible] to be entirely in oil, were painted in this manner, and then glazed [illegible] finished with oil colour.

There can be no doubt of the durability of this mode of painting on walls, as there are many well preserved examples of it by the early masters, but I am unable to quote any instance of the successful adoption of the process in modern times. Professor Overbeck informed me that he painted in this manner at Assisi, but that it was necessary to lay a ground of white [illegible] on the wall in the first place, a process which is manifestly objectionable and not in accordance with ancient practice.

An Italian artist informed me that it is necessary first to give the wall a coat of strong size, and then to give it a second coat mixed with the yolk of egg and vinegar.

Another mode of painting on which the [illegible] appear to be a few early examples, and of which there are many later ones, is called by the Italians *fresco secco*. I was informed that a large painting by Orcagna in the church of Sta Maria Novella is in fresco secco. I examined it, but hesitate to pronounce an opinion.

The later masters painted extensive works in this manner [illegible] the great hall in the Barberini Palace in Rome appears to me to be in fresco secco, and in Rome, Florence, and Genoa, the ceilings of most of the palaces are covered with paintings executed in this manner, it is the mode of painting still adopted in Italy for nearly all decorative purposes, is easy of execution, and unquestionably durable, whilst it is certainly the most economical process which can be followed.

Fresco secco has been practised for some time in Munich, the ceilings of corridors of loggie and those of staircases, are thus painted in the palace, and the Chevalier Von Klenze, who first introduced the process at Munich is satisfied with the experiments which have been there made with it.

The following is a description of the method. The plastering of the wall having been completed and lime and sand only having been used for the last coat, the whole is allowed to dry thoroughly. When a wall is intended to be painted, the surface of the lime is rubbed with pumice stone, and on the evening of the day preceding that on which the painting is to be commenced the plaster is thoroughly washed with water, with which a little lime has been mixed. The wall is again wetted next morning, and then the cartoons are fastened up and the outline is pounced. The artist then begins to paint. The colours are the same as those used in fresco-buono, and are mixed with water in the same way, lime being used for the white.

If the wall should become too dry, a syringe, having many fine holes at the end, is used to wet it. Work done in this way will bear to be washed as well as real fresco, and is as durable for ornament it is a better method than real fresco, as in the latter art it is quite impossible to make the joinings at outlines, owing to the complicated forms of ornaments, on this account walls thus decorated in real fresco present an unsatisfactory appearance. The joinings are particularly observable in the loggie of the Vatican.

Painting in fresco secco can be quitted and resumed at any point. The artist need not rigidly calculate his day's work, and can always keep the plaster in a good state for working on. But whilst it offers these advantages, and is particularly useful where mere ornamental painting is alone contemplated, it is in every important respect an inferior art to real fresco. Paintings executed in this mode are ever heavy and opaque, whereas fresco is light and transparent. Fresco-secco has been chiefly adopted by late and inferior masters, and none of the works executed in this manner are of great reputation. The only pictures which are designated by the Italians as works in fresco secco are not probably executed in this manner. The method may have been adopted in repainting parts, and this may have led to the idea that entire works were thus executed.

Fresco secco is extensively used in Italy at present, and with great success: the chiaro scuro decorations executed in this manner are excellent, but I found that at Milan where I had an opportunity of examining some specimens, it did not bear washing like the Munich process. The method seemed the same, but the result differed in this respect, and I had no opportunity of seeing the actual process of paintings executed in this mode, in any other part of Italy.

At Genoa, where the paintings in the churches and palaces have no claim to be called frescos although generally so described, a compound process has been followed in their execution. They were all commenced, or partly commenced in fresco, but were finished in distemper, and size has been used in mixing the colours, as they can easily be removed by washing. The object of the Genoese artists has been to supply the fancied deficiencies of fresco painting in point of colour, but, although they have succeeded in making use of vermillion, brilliant green and bright yellow, they have not produced satisfactory works of art. The paintings are garish, and out of harmony, the colours subsequently added in distemper do not harmonize with those previously used in fresco, and the general effect is totally devoid of that transparency which is distinctive of good fresco painting. The Genoese have brought fresco down to the level of mere size painting, and the works which they have left are proofs of the danger of carrying the practice of retouching too far.

In the Doria Palace instances occur in which it may be observed that the entire picture was not prepared in fresco and then retouched in distemper, but that portions were painted in fresco and then, the plaster being allowed to dry, the remaining portions not previously touched when wet were begun and finished in distemper. Perino del Vaga, or perhaps Pordenone who painted in the same palace, may have introduced this practice as well as others equally objectionable.

The annexed wood cut, fig. 6, exhibits a contrivance for a scaffolding, &c., formerly and still in use in the practice of fresco painting.



[illegible] lamp on the [illegible]

THE ARCHITECTURE AND ENGINEERING OF AGRICULTURE; OR, COLONIAL DIVISION OF LANDS AND ITS RESULTS.

Under the above paradoxical and high sounding title, I propose to draw the attention of the landed gentry and farmers of this country to the results of the proceedings of the Colonial Land and Emigration Office, in their treaties with the North, South and West Australian colonies, also the colonies established in New Zealand. The Crown granted to the New Zealand Company, established in 1839, lands to the extent of 1[illegible]0,000 acres, at Port Nicholson, in one block, or more of such blocks six might be [illegible]000 acres, and the rest 30,000 acres, each block to be a continuous tract bounded by the natural landmarks of the country. The government is to define and make the survey of the external lines of every assigned block, and arbitrators nominated by the Government are to determine the price of the interior survey of each block of 1000 acres. The land is to be sold progressively, as the surveys are completed, at one uniform price of 20s. per acre.

A second colony was formed in March, 1841, under certain stipulations, viz., the site to be chosen in New Zealand, (the site is since selected and named Wellington,) and to extend to 201,000 acres, which was to be divided and sold in allotments, each allotment to consist of three sections, one of 1[illegible]0 acres of rural land, one of [illegible]0 acres of accommodation land near the proposed town, and one of 1 acre of town land. Priority of choice to be decided by lot, the fixed price of each allotment to be £300, and upon which a deposit of 30*l.* was to be paid to the Company's bankers, and on the payment of the full purchase money, three separate land orders to be given, which were also to be determined by lot. The Company reserving a right to purchase 100 out of the 1000 allotments, subject to the same conditions as the other purchases. An amount equal to 2[illegible] per cent of the purchase money paid by the colonist to be allowed towards cost of cabin passage, outfit, &c., in the order of their respective applications, and the other 7[illegible] per cent to be appropriated towards the Emigration Fund.

A revival of the sales of land is now in course of being established by the New Zealand Company, for planting a third colony, to be called New Edinburgh, the site to be a block of 120,5[illegible]0 acres. The original grant from the Crown to the Company was at the rate of [illegible]s. per acre, and from what precedes this, it will be seen that the Company charge in the first instance a uniform price of 20s., and which is increased in the second and third colonies to 30s. per acre.

What I propose to denominate the architecture of agriculture, is the terms and limits employed in the dealings with the Company and the Government, and the terms employed between the Company and the emigrant purchasers. I propose to call the engineering of agriculture, the means to be used to occupy or make the land tenantable. First then as to architecture, we have the term block used, to specify an indefinite extent of country, then specific blocks, to specify a continuous tract of country, bounded by its natural landmarks; these specific blocks are limited in size and number, as in the instance of the first settlement of the New Zealand Company six may be of [illegible]000 acres and the rest of 3[illegible],000. The Government survey the boundaries of the specific blocks as soon as they are assigned. We have now the term specific assigned blocks and a proprietor, who now appears for the first time entitled to a block of land, say one of the six of [illegible]000 acres, as mentioned above, so much for architecture of agriculture.

The engineering, or means of occupation by the proprietor, is now to be considered. The external boundary of the blocks, as before stated, is first surveyed by the Government, and the Government and Company fix a scale of prices for the interior survey of each 1000 acres. When a purchaser is obtained for one of the blocks, we have a proprietor of an assigned block ready to treat with purchasers of lots of 10[illegible]0 acres each, or a section, viz., a portion of a large lot, we have then a large landed proprietor ready to treat with a purchaser for a section of land. Suppose the block to obtain a name from some peculiar feature of the country, as a mountain, say Mount Barker, the block then has a distinct name, and the term is changed to a district, as in this suppositious one, "The Mount Barker District," this district will afterwards contain several surveys of 1000 acres each. Now supposing a purchaser has been found for a section of land, another name is then required for the allotment, say in this case, that it shall be called Dutton, the purchaser is then entitled to ask for a survey, which when complete, he will be ready to sell into smaller sections to be occupied by purchasing emigrants. On the arrival of emigrants, they generally employ an agent on the spot to select a section of land for them. Supposing the agent to have fixed a location, it would then be designated, in the phraseology of emigration, a section situated in New Zealand, the name of the country, in the Mount Barker district, in Dutton's survey, section 120[illegible], or as the case may be. Next, suppose the emigrant's hut built, and he gives it a name, say, Ballimmah, and others follow his example, we then begin to get rid of all sections and blocks, and in the mind's eye, have arrived in Her Majesty's loyal town of Ballimmah, new Zealand.

But to return to see what has been actually done in carrying the above plans into effect, we first have the settlement of the New Zealand Company, then the district called Wellington in Port Nicholson. In this district in July, 183[illegible], 1123 emigrants had arrived, and in March, 1840, the town contained 3000 inhabitants. The amount or extent of the land order in this case was for one acre of land and 100 acres of rural land. A second Company was then called into existence, which has subsequently merged into the New Zealand Company; they erected a settlement called New Plymouth, where the amount of land orders was reduced in extent to a quarter of an acre of town and [illegible]0 acres of agriculture, the whole block consisting of 57,[illegible]00 acres, exclusive of roads, which was divided into 2200 town sections, containing in the aggregate [illegible]0 acres, and 209 suburban or agricultural sections, constituting the remainder. Before the emerging or amalgamation of the New Zealand and the rival Companies, the latter had sold 1000 town sections, 51 suburban sections, and 11[illegible] sections of rural land, (a third term now introduced for the first time,) and there have been sent out by the emerged Companies, to this, the second settlement, called New Plymouth, 308 male and 201 female colonists. The second settlement of the New Zealand Company, or third yet projected, is to be called Nelson, the site of which is not yet chosen. It is to be divided and sold in sections of [illegible]01 acres, viz., one acre of town, [illegible]0 suburban, and 1[illegible]0 agricultural, to be sold at the uniform price of 3[illegible]s. per acre, which is at the rate of 7*l.* per acre for town lands, and so on.

From what has been previously said, it will be seen that one of the stipulations was, that the Company reserved the right of purchasing in the first instance nearly one half of the whole settlement, and by introducing three terms into the conditions, and consequently three different orders of land. The land orders sold in this country are for the suburban and agricultural, the town land being retained as a grievous monopoly, and with a non residence of thousands of miles.

In Mr Jameson's account of New Zealand,[2] who was surgeon superintendent of emigrants to South Australia, and to whose account I am indebted for many of the details of the size of blocks of land, he says, at page 112, "The owner of a land order entitling its holder to the first choice of a town allotment in the New Zealand Company's settlement of Port Nicholson, refused to sell his priority of choice for £1000; and that sheep farmers now proceed beyond the boundaries of location by paying for the pasturage, or a squatting license." As a further proof of the establishment of the land monopoly in the colonies of the New Zealand Company, I may add the substance of a letter in the *Times*, September 26, 1843, and dated Wellington, March 9, 1843, from an officer of artillery, practising as a private surveyor, he says, "I wish something could be done, if not to tax the absentees, at least to give encouragement to *bona fide* settlers. The agents are confined by the absentees to grant no other terms for forest land than a lease for seven years," which is evidently of no use to the settler, the absentee coming in for all the settlers improvements almost as soon as any improvement has taken place. To Charles Dickens's Martin Chuzzlewit the public are deeply indebted, for the bold manner in which he shows up the system pursued in America, with regard to emigration, in his graphic description of taking possession of an allotment, he says, "At last they stopped—at Eden too—the waters of the deluge might have left it but a week before: so choked with slime and matted growth, was the hideous swamp which bore that name."

I will now state what has been achieved in Australia. New South Wales was colonized in 1788, West Australia in 1829, South in 1834, and North in 1838, and their populations in 1839, were respec-

[1] The New Zealand Company it must be remembered have received these grants in compensation for the claims they had raised by purchases from the native chiefs in the same manner that compensation was granted to other holders of native claims. Moreover it is to be observed that it is the practice for government to make sales of large tracts in the colonies to land companies at a reduced price, by which the government immediately receives a large sum, while the Company lay out a large capital in improvements and the introduction of emigrants. On such principle large grants have been made to the Canada, New Brunswick, Australia, Van Dieman's Land, British American, South Australian, New Zealand, and Australian Land Companies. The New Zealand Company we believe do not purpose to take a larger sum than [illegible]s. per acre for their own profit, the rest being devoted to emigration, education, churches, steam navigation, roads, harbours, &c.—EDITOR.

[2] Published 1842, Smith & Elder.

tively 78,000, 4,000, and 13,000; the population of North Australia is not given, but Van Dieman's Land is stated at 43,000. Australia has suffered equally with New Zealand in regard to the disastrous effect of a slow and inefficient survey, and from the injustice of the Special Survey Law prohibiting the cutting of wood and cultivation of the ground in unappropriated lands. The enormous amount of £4000 is requisite to get a special survey. The squatting system is mostly acted upon, which is a complete bar to the cultivation of the land for agricultural purposes, in consequence it only remains pastoral. The squatters pay a licence of 10s. per annum per square mile, and who upon their leaving are paid for the stock yard by the proprietor.

I have perused the letters of a relative who arrived in Adelaide, South Australia, in September 1839, and from whose experience and residence I am indebted for the following fact connected with the country as regards the system pursued with respect to lands, its price and suggested improvement. The cost of a Special Survey has been stated, which entitles the parties to a selection of as many acres as pounds are paid for the survey out of 23 square miles which is allowed to extend twelve miles in length, and any breadth, to make up the quantity, by this means the county is gutted of good land, and the remainder is unsaleable on account of its distance from a common crossing or reserved acre with water, it also prevents cultivation as good land is kept for sheep runs, to prevent which, as also the bad land remaining for ever on the hands of government, it is recommended to divide the blocks into 640 acres or square miles, and again to divide them into sections, say two of fine land with water, three hilly with water, and three wood and mountain, and to make the price proportional to the 20s. value, and to fix a maximum price for each description to prevent malignant bidding, at 40s. for fine land, 20s. for hilly, and 6s. 8*d*. for mountain. At present the special surveys generally bring from 50 to cent. per cent. profit after examined by the public, five per cent is paid on a survey to the party who discovers and marks the boundary of the proposed survey, and five guineas is paid to an agent for the selection of each section, which is a much cheaper and better plan than exploring the land personally, and if a special survey is required, a year will elapse in waiting for the leisure of the surveyor, and of these surveys already completed the proprietors pick out portions and delay the rest, and monopolize the district by reserving those containing water, and to prevent small holders of land orders coming and settling and sharing with the large resident proprietor the sheep runs, they have large districts surveyed, and then allow them to be occupied by squatters, the proprietor picking out all the best sections. To counteract this an attempt is sometimes made by an association of small capitalists joining and getting a special survey jointly, and fixing previously a sole arbitrator to fix the site of each location, but this plan did not succeed on account of the squabbles occasioned by the selection and the delay in fixing the site of each party to the joint survey although land has been obtained by this means that sold for 30s. to 70s per acre. Unsurveyed lands in Mount Barker district of South Australia have been sold as high as £60 per acre. Of those land orders which have not been appropriated, the old ones have a priority, and are reserved to pounce on good sections as soon as they are surveyed, in preference to recent emigrants. Some of these land orders have been sold with three months credit as high as £70, and one a year old for £90, and one of older date for £100.

I will now proceed to give a description of the result of the emigration of my relative as regards his prospects, and a description of his location. He sailed from Scotland March 15, 1839, and arrived at Port Adelaide on the 30th Aug following. On Sept. 26, he removed to Adelaide Town, and took a lease for fourteen years of a corner site, 79 ft. front, and 70 ft. deep, in Hindley Street, at a rent of 1s. per foot per annum. He bought, through an agent, an 80-acre section of suburban land for £210, in Mount Barker District,* on which he erected an inn at a cost of £90, built of turf, and thatched, which he has let for five years, at £100 for the first, and £125 for four following years. he has sold two and half acres in allotments, which yield £28 per annum. he has also sown 25 acres, which with seed cost £120, also one acre of whins, furze, or gorse, and planted 70 trees, viz. apple, pear, plum, peach, quince, apricot, citron, gum trees, and vines, he has also sown the following seeds—cherry, damson, cape gooseberry, hop, cocoa-nut, peas, beans, turnip, water and rock melons, pumpkin, cucumber, cabbage, sixteen varieties of greens, potatoes, plum, orange, grape, cotton, silver tree, capsicum, and aloes.

The thermometer in the shade stands at 76 to 90°, and in the sun at 115° to 120°. In the colony of South Australia there are about 12,000, although Mr. Jameson says 15,000 inhabitants, and in Adelaide alone one-half reside. The price of land in town is from £8 to £20 an acre. In the town of Adelaide the streets are laid out rectilinearly, there being about three houses on each acre, it is divided into two portions by a valley, in which runs the chain of pools called the River Torrens the intervening ground is reserved as a common. Seven miles is the distance to Port Adelaide, the nearest point at which vessels can load. The principal street is Hindley Street, three quarters of a mile long, and its continuation, Rundle Street, but King William Street, leading from the Government House and Post Office, will be the most superior. Currie Street, next Hindley Street, to the south, is being filled up, but not closely, and beyond it houses are erected having little appearance of a town. Rosina Street is the name of another, in which my relative temporarily set up his tent. In Hindley Street a site, 25 ft. × 18 ft, was let for two years on lease at a rent of £83 per annum, and £40 was paid for the lease another, with a frontage of 80 ft. × 100 ft., was let for 30s. a foot per annum.

The following is a description of the buildings. The Capitol is a mud house, with a reed roof, a sheet for a door, and an apron for a window, the Post is cornered with brick. There are a few brick houses. The English church is built with rubble stone, and is already in a dilapidated state, and has been partly rebuilt with a square tower at one end, with a shingle pyramid and transept intersecting the other. The Methodist building is ornamented with four Doric columns and pediment the span of the roof. The Independents are seeking subscriptions, and the Seceders and Kirk of Scotland are also about erecting places of worship. In the vicinity are several Germans who have settled, carrying with them their peculiarity of construction four miles north 200 are settled on the division of labour and profit, and at a distance of 28 miles is their settlement of 2000 acres called Klemzig it is a long street, with isolated houses in gardens, with the gables towards the street. They have another settlement eighteen miles off, and which was one of the first special surveys it is named Hansdorf, it is not so clean in appearance as Klemzig

The port where the Post Office and bonded stores are is badly situated, boats of two feet draught grounding in the mud Large ships lie at the intersection of the north arm of the creek nine miles from port, but four miles higher up many ships lie there having fifteen feet water The height on the bar at top of tide is sixteen feet. To remedy the inconvenient situation of the port the South Australian Company is making a road to the creek, and propose to erect jetties. A canal is already cut through the swamp, and a road is making alongside, towards which each cart visiting the landing brings a load of sand from the hill as toll. The creek is called the Sixteen-mile Creek, and for twelve miles is lined with mangroves, the distant hills backing the landscape. The range is a gradual rise from Encounter Bay Mount Lofty is six miles from town, and is 2200 feet high, Mount Barker is a few feet less, and commands a view of a dozen surveys. Both these mounts have given names to the districts adjoining. The roads are laid down straight, with cross roads every four or six sections.

Mr Jameson, in his work before alluded to, mentions crossing the hill range in Mount Barker District with two Scotchmen, one of whom was my relative, and from whose letters I have collated the preceding notes They took the old Tiers road by Mount Lofty, and visited the Cattle Company's station, and passed through Meadows' Survey, Smallies' Survey, and the Three Brothers' Survey, on the bank of the Onkaparinga or Angus River, and then proceeded 25 miles south on the Wollinga River, where the land is good, and some eligible sections taken The Angus River and Hindmarsh River, the latter near to Lake Alexandrina, are the discoveries of Mr Cock, who is fully described in Jameson's work as a successful emigrant.

The colony was founded in 1836, and in a Parliamentary Blue Book published in 1842, the present governor states that the entire population is 16,000, of which there are in the town 8174; and that there are 63 public-houses and that in 1841 the government revenue was £30,000, and expenditure, £150,000, and that 3000 acres were under cultivation, and that a gaol, which is incomplete, had been erected at a cost of £32,000, or more than one year's revenue. During 1842, the land under cultivation had increased from 3000 to 19,000 acres, and the crops were valued at £98,000; so that, from the above account, the trial may be said to be over, and the colony fairly planted, the trials that have been undergone being the reverse of Dickens' Eden, and more like the terse language of Scripture, Australia being a land "wherein no waters be," at least the fact of water being reserved as a monopoly is *prima facie* evidence of the scarcity of it.

In conclusion, the division of the land by arbitrators, the effect of inefficient survey, the Company's reserves, and the squatting system,

* Section 4208 in Dutton's Survey near Onkaparinga or Angus River and road to Smallies survey, and passes one end and the side or road to Mount Barker in which 8080 acres are surveyed

[illegible] the variation of landholders in extent and [illegible] the land the terms on which the absentees only [illegible] and the restrictions imposed as regards timber wood, and the [illegible] cultivation of the ground, and the enormous amount of rent charged for [illegible] town sections, has also been [illegible] and I will [illegible] to say whether [illegible] immigration is likely to be obtained [illegible] and the statement of the [illegible] of South Australia, as to the number of public houses, I think sufficient to prevent the [illegible] feelings to [illegible] from the [illegible] from Mr [illegible] orders of rum [illegible] fortunes in [illegible] on the new arrivals. This also shows that there is no [illegible] —no sympathy with new comers, and that [illegible] to be continued with [illegible] in this country, and it must also [illegible] scheme.

With respect to [illegible] price of [illegible] the [illegible] a week and food, until he finds a master, and the wages given by masters is from [illegible] and keep, and men working by job work [illegible] and wood splitters will [illegible] 20 a day, and instances are known [illegible] 00 per day having been made. The cost of [illegible] fifteen yards [illegible] per yard.

[illegible] of provision for emigrants in the voyage, [illegible] also [illegible] profit realized by the [illegible] arrival, but [illegible] exactly the [illegible] fear of long [illegible].

As [illegible] individual among [illegible], I am [illegible] prejudiced in favour of the [illegible] and [illegible] on the full tide of civilization, that I am almost inclined to think, with a quaint [illegible] who said "he would rather be [illegible] than die a natural death elsewhere." [illegible] what I have merely [illegible] to give parties the means of better judging of the [illegible] position of the arrival in the colonies.

[illegible] O. I.

REVIEWS

Specification of a Patent granted to P. M. PARSONS, *of [illegible] Road, Surrey, for "certain improvements in [illegible] and [illegible] locomotive machines [illegible] therewith, &c."* G. Hebert, Cheapside.

Mr. Parsons has evidently great expectations and hopes to ascend to the pinnacle of fame by his inventions, of which examination we have very considerable doubts. If we were to judge of his abilities by the extent and number of his improvements, we should rise from the perusal of his pamphlet with a high sense of his merits; but unfortunately, if the wise saw is ever applicable, it is so here—that "what is new is not useful, and what is useful is not new."

But to show that we are not among those who avoid condemning novelties, without enquiry and examination, we will point out where Mr. Parsons has encroached on the property of others, and where he stands as and they appear to us to be in two) in an impracticable point of view untenable and useless.

Mr. Parson's patent is divided into eleven branches; the first of which contains eleven claims; the second branch has two; the third the same; the fourth one; fifth five; sixth five, and the seventh, eight, ninth, tenth, and eleventh, one claim each, in all no less than *thirty-six distinct claims or inventions*, so that our readers will perceive we have taken upon ourselves a somewhat laborious office, even if we notice only the most prominent. The first branch applies more particularly to the employment of high steam and locomotive boilers, surface condensers, and double cylinder engines for marine purposes, of all these suggestions, one only is new, the locomotive boiler, we use the term in its strict sense, and as it is evidently meant to be by the patentee—namely, constructed on the same plan as those employed on railways, and as he has drawn them, Figs 1 & 2, sheet A. Now, we believe it is generally known, that for three or four years past, boilers on the locomotive plan have been adopted in steam vessels on the river Thames and elsewhere, and although generally, and more appropriately, termed "Tubular Boilers," are in all essentials exactly identical in principle with the railway locomotive boilers; and we have reason to know such are now working under a much higher pressure of steam than the public have any conception; or is a knowledge of the value of *expansion* new, either in theory or practice; and Mr. Parsons will find that we have made much greater progress in the art than he appears to have any knowledge of.

There can be no doubt, that when the proper time arrives, when by safe and careful experience we can make a further advance in the use of high steam, by an increase in the amount of pressure, that a considerable saving will arise in the consumption of fuel, and a decrease in the necessary boiler room; theory has told us this for many, many years past, but in these matters, theory waits upon practice, and the state of the latter may be judged of from the recent works of some of our most eminent engine makers.

But is it probable that the railway locomotive boiler, as figured by Mr. Parsons, will be introduced on shipboard?[1] We think not, because the shape is that of least capacity compared with space occupied; and experience has detailed better forms and arrangements, quite capable of bearing as great pressures, and which enables the engineer to occupy to advantage all the space allowed for his machinery. If, therefore, Mr. Parsons does not strictly adhere to his specification in this particular, he will merely follow in the footsteps of [illegible], Seaward, and others too numerous to enumerate, and his invention is therefore "useful but not new."

We could have wished that some scale had been attached to the drawings in the pamphlet, so that we might have brought to bear upon Mr. Parsons schemes the test of figures, combined with practical experience of the requirements of marine machinery, and it appears to us, we could have satisfactorily shewn that he is far behind both in his theory and practice of such engineering. Dismissing, therefore, the boiler, we pass to the engine, and we have (although disguised by Mr. Parsons' ingenuity), nothing more nor less than Hornblower's scheme, as patented by him in 1781, (see Farey, page 351, and Gregory's Mech. Vol. II, page 355) or perhaps more strictly speaking, we should say Woolf's engine, inasmuch as Mr. Parsons proposes to use high pressure steam in his small cylinder, and expand it in his large one. Hornblower, on the contrary, employed low pressure steam. But, Mr. Parsons' complicity is beyond all endurance, valves upon valves, and steam and vacuum passages without end, the former placed in situations where they cannot be conveniently examined, the latter rendering the casting of the part a most difficult and critical proceeding. It further occurs to us, that by the employment of *two* piston rods, he somewhat encroaches on Maudslay's patents of 1840 and 1841, (see our *Journal* of March 1840 and October 1841,) and is in this and in its method of securing the lower end of the connecting rod, an exact infringement upon the designer of the *Prince Albert's* engines, whose name we forget, but believe to be by birth a Swede, and between who and the Messrs Maudslays, we hear, a tacit understanding exists, arising from mutuality of invention, or rather adaptation or use, for we cannot, directly such things by the term "invention."

And what are Mr. Parsons' condensers but *surface condensers*, differing, only in detail from Cartwright's of 1797, from Mr. Watt's gridiron condenser, and later still from Mr Hall's, the latter employs pipes, Mr. P's are corrugated iron plates; disbelieving, as we do, in the advantages said to arise from the use of surface condensers, we, however, cannot allow this opportunity to pass without bearing our small tribute of admiration to Mr. Hall, for the ingenious and scientific way in which he has carried out his improvements upon Cartwright's surface condensers, for although it was formed of plain plates, we contend the principle is the same, Mr. Watt introduced pipes, and tried numerous experiments, but failed. We have yet to learn that Mr. Hall is more fortunate, but be that as it may, his arrangement for supplying the loss of distilled water is really beautiful, and upon which Mr. Parsons' is a sad parody and burlesque.

We have hitherto principally treated of what Mr. Parsons does *not* claim *per se* but *collectively*, as an entire machine, let us endeavour to trace out what is his individual merit, and how far he has added to our stock of knowledge.

The *eleven* claims in the *first branch* put us in mind of what is called "ringing the changes," being a species of involution of surface condensers, high pressure, and double expansion engines. The third claim in this branch, is, we believe perfectly new, whether useful or not remains to be proved, we allude to the double action air pump, with separate valves and offices, the one at bottom to remove the condensed *water*, that at the top to pump away the air and uncondensed vapour accumulating in the condensers; it is but an experiment, and we have doubts of an advantageous result, particularly when we reflect that the single acting air pump in the common engine produces a vacuum of 27½ in. frequently 28 in., the condensed water being at a temperature of 100° or thereabout, which experience shews to be the best for

[1] We do not enter into the question as to the advantage of expanding in one cylinder as Watt, or in two, as Hornblower.

economical purposes. By Mr. Southern's rules (an authority above question) as given by Farey, page 73, it follows that the vapour arising from water heated to 102 is equal to a pressure of 1·97 in. of mercury, therefore taking 27·2 + 1·97 we have 29·17 in., or only 0·83 in. below the mean barometric column in this country, which we opine, leaves a very small margin for inventors. We now pass to the *second branch*, which describes a double cylinder engine. Woolf again, with a small spice of Mr. Joseph Maudslay's patent of 1841 (before adverted to) we have here, two piston rods and an annular cylinder, the internal cylinder to be used *a la Woolf*, for high steam, besides a patent by Mr. Gillman has been already secured for using two cylinders one within the other, and adopted for the same purposes as Mr. Parsons proposes.

Without being hypercritical upon descriptive drawings to so small a scale, we shall content ourselves with remarking, that we cannot see how Mr. Parsons means to fit, adjust, and repair the small sliding valve, E F, Fig. 7, sheet A; or how to make good the wear and tear of the valves, N and M, with their *triple* faces, or to secure and make tight the cylinder cover, and lastly, how all this complication is to be manipulated and worked? These are practical points which suggest themselves to us, for the means described in p. 6 are, in our opinion, totally inefficacious.

The *third branch* comprises a scheme that really provokes our cachinnation,—we believe it to be entirely new, although Mr. Parsons does not claim its leading principle—the reciprocation of the *cylinder* upon a *fixed* piston, stating it to have been used; if so, we conceive it must have been on a very *small scale*.

The *fourth branch* consists of an arrangement of steam engine, "having for its object the better application of the power for driving screw propellers." It is on Woolf's plan, but evinces considerable ingenuity —but it is objectionable on account of the spur gearing, which has been found the great difficulty in applying and working screw propellers.

The *fifth branch*, for disconnecting paddle-wheels from the engines, so that they may revolve when the ship is under sail, would be expensive in fitting, and useless in practice. Many other schemes are known of far greater superiority; among others, that of Trewhitt is prominent.

The *sixth and seventh branches* introduce more complication where there is necessarily too much already, namely, in the locomotive engine.

The *eighth branch* is an invention for supporting the main plummer blocks of marine engines. This is verily an "invention," for we feel assured nothing of the kind was ever seen before. This, like the third branch, assures us of what we previously had an idea—that Mr. Parsons's ingenuity far exceeds his practical knowledge.

The *ninth branch*, an improved packing for pistons and stuffing boxes, like the fifth, is useless, because far better means are in use, as those of Maudslay and of Robert Napier.

The *tenth branch*, an improved cock and plug, is absurd.

The *eleventh branch*, for preventing cams turning round with the shaft, is absolutely preposterous, because it can be, and is done, by more simple arrangements.

This, then, completes our analysis of Mr. Parsons' patent. We cannot, however, conclude without protesting against this whole mode of making up a patent and observing, that he cannot reconcile, with the honour and dignity of the profession, thus bringing together other men's inventions, disguise them under a thin veil of doubtful improvement, and make the compound the subject for a patent.

Weale's Quarterly Papers on Engineering, Part I. London: John Weale.

Weale's Quarterly Papers on Architecture. Part I. London: John Weale.

Mr. Weale, having succeeded so well with some of his annual publications, particularly the papers of the corps of Royal Engineers, has now commenced two quarterly miscellanies, one devoted to engineering, and the other to architecture, as the means of preserving those papers which, without being of sufficient bulk to justify an independent publication, are yet too long for our columns, or require a greater extent of illustration than we can devote to any one subject. We see that the design includes scientific memoirs, the lives of eminent professional men, republications of American works, and translations of important communications from the French, Dutch, and other foreign languages. When it is considered that the works will each form a handsome volume at the end of the year, expensively illustrated, and at a moderate price, we are sure these new enterprises will receive that support from the two professions which they well merit.

The engineering part not inappropriately commences with a copious life of Brindley by Mr. Hughes, C.E. It gives full details as to his works, and is illustrated with a copper-plate portrait. Another memoir succeeds this, namely, one on Wm. Chapman, C.E., for whom is claimed the invention of the skew arch, first applied by him, in 1787, on the Kildare County Canal in Ireland. Originally employed in the merchant navy, his attention was early directed to hydraulic engineering, which, on the advice of Watt, Boulton, and others, he determined on pursuing as his profession. He was consequently employed on a number of canals and docks, and, among others, on the London Docks. He was also the author of several useful professional works, and of many valuable inventions and improvements in mechanical processes, particularly in rope-making, and the shipment of coals.

We have afterwards a paper on the dredging machine, with three engravings, and entering into the history of that invention, but to which, as it is likely to be the subject of controversy in this *Journal*, we will not at present enter. The plates describe a machine constructed under the direction of the late Mr. Rennie, in 1802, for raising mud out of Messrs. Perry's dock at Blackwall, and another used at the Hull docks in 1808. In this paper it states that "the piles (600 in number) for the coffer-dam of the Wapping entrance of the London Docks, constructed by Mr. Rennie, were driven by one of Boulton & Watt's eight-horse engines in the year 1801. Next comes an account of the engines of the Russian war steam frigate, the *Kamschatka*, constructed at New York by Messrs. R. & G. L. Schuyler. Four plates illustrate this subject, and a description is given of several peculiarities in the construction, for which we cannot say much in its favour. We will, however, let the engineers give their own reasons.

"In the United States, the most approved method of using steam is expansively, that is to say, by having a high pressure in the boiler, cutting off the steam from the cylinder after the piston has performed say one quarter of its stroke, and allowing this high steam to expand through the remaining three quarters of the stroke. To this system to work to the best advantage very long cylinders are required.

"Having determined upon adhering to this method, so successful in our river steamers, it became necessary to adopt some plan by which the length of cylinder could be preserved without elevating the engines above the deck, or cramping the action of the connecting rod, as is seen in some English government steamers. By reference to the drawing, you will observe that any desired length of stroke can be obtained without adding to the elevation of the engines, and also that the connecting rod has great length and free action. The advantages of placing the cylinders in a horizontal position, firmly secured to the keelsons, and bolted down through the hull, are also very great. The strain of the engine is fore and aft, which tends greatly to relieve the ship. The engine takes up much less space in width than any other; there is consequently room for coal-bunkers ten feet wide on each side, thereby rendering the engines completely shot proof. In this plan we retain vertical air pumps, force pumps, and valves. The steam and exhaustion valves are of the kind commonly used in the United States, known as double balance valves. The valves used for expansion are of our own contrivance, and peculiar to this ship, they are worked by a separate eccentric and rocker shaft, which is so set as to follow the motion of the steam valve, cutting off the steam at any point of the stroke which may be desired; they can be thrown out of gear instantaneously, without stopping the engine. The triangle or half beam, which forms the connexion between the piston rod and the connecting rod and cranks of the engine, can be so arranged, by altering the centres, as to make the cranks of any length which is thought most advisable, without reference to the length of stroke of the piston. In the case of the Kamschatka's engine, the cylinders are 65 in. diameter, and have ten feet stroke, while the cranks are but four feet in length, and you will readily perceive that any leverage lost in shortening the crank is exactly counterbalanced by the gain upon the half beam. The steam is cut off at one third of the length of the cylinder. The number of strokes of the piston are from 26 to 34 per minute—on an average 30; thus requiring 1260 cubic feet of steam per minute, of an average pressure of 12 lbs. per square inch above the atmosphere. She has four copper boilers, (constructed for burning anthracite coal) each 10 feet long, 12 feet 6 inches wide, and 11 feet high, the flues all centering in one chimney, 7 feet in diameter, and 46 feet high above deck. Each boiler has four separate furnaces, the heated current is taken from each furnace through 100 copper tubes, each 28 inches long, and one inch in diameter in the clear. From any one of these furnaces, by a peculiar construction of a revolving grate, the coals can be instantly dropped, and the tubes in that furnace can be swept out and cleaned while all the other furnaces

are in active operation. Some doubts were entertained by engineers in this country as to the possibility of keeping these small flues tight, and also as to their choking up on a long sea voyage. Our experience in the *Kamschatka* completely settles that point. Of the 6400 tubes in her boilers, not one is known to have failed in any respect. After passing through these small tubes, exposing an immense quantity of fire surface, the heat is carried by ordinary cross flues through the upper part of the boiler over the arch of the furnaces to the chimney. The consumption of anthracite coal in the *Kamschatka*, to furnish the supply of steam above stated, varies from one ton to one ton and a quarter per hour. We would also remark, that the same boilers answer, though not so perfectly, for the consumption of bituminous coal. On the voyage from Southampton to Cronstadt the latter coal was used, the average consumption being 32 tons in 24 hours.

"The plan of engine used in the *Kamschatka*, and known as 'Lighthall's Patent,' is gradually coming into general use in these waters. A new steamer for the Hudson river, now building, 32[illegible] feet long, which is expected to excel in speed all others, is to be supplied with these engines, the proprietors having already tested the plan for several years in the largest and finest boat on that river.

"The *Kamschatka*, planned and constructed by us for the Russian government, is a man of war steamer of the largest class, carrying a heavier armament than any steamer. She is a double decker, carries on the main deck eighteen long 36-pounders, and on her spar deck two guns of 10 inch bore, one forward and one aft, revolving in whole circles, and two guns of 8 inch bore, revolving in half circles. Her length is 216 feet, beam, 45 feet 6 inches, depth, 24 feet [illegible] inches, tonnage, 2049 [illegible], draught of water with crew, ammunition, provisions, water for a cruize, and fuel for 26 days, 16 feet. The performance of the ship, in a very stormy and tempestuous voyage from New York to Cronstadt, in the months of October and November, 1841, was entirely satisfactory. Her rate of speed was from 10 to 12, and occasionally 12½ knots per hour. Under sail, her engines being disconnected, she has made 197 miles in 24 hours. In the heaviest weather she was steered with perfect ease, and shipped no sea during the whole voyage."

Mr Joseph Gill has contributed some hints and improvements of the steam engine, which require to be separately considered.

We see that for the next number much matter of interest is promised by Mr Weale, and particularly papers on the light houses of England, France, and America, the hydraulic works of Holland, and the ship-building of the United States.

The Quarterly Papers on Architecture commence with "an Essay on those Powers of the Mind which have reference to Architectural Study and Design," by Mr George Moore, well known for his talent and abilities in architecture, as well as the fine arts generally.

The next paper refers to the Greenwich poor house, by Mr R. P. Browne, the architect of the building. It is accompanied by four plans and an isometrical view. The arrangements for classifying the inmates appear to be well carried out, and are of an extensive character, affording accommodation for near 12[illegible] persons, the cost being, on an average, about £24 per head. The following is the cost of the land and buildings.

				£		
Purchase of land and expenses				1,8[illegible]		
Forming a sewer to the river, about 2[illegible]0 feet, and other works				1,200	0	0
Contract for house	£18,[illegible]71	0	0			
Additional works in buildings and fittings	3,[illegible]4	0	0			
Artesian well and treble-barrel pump	208	11	11			
Boilers and furnaces for washing	[illegible]	[illegible]	0			
Steam cooking apparatus, eight baths, boilers, stoves and fenders	720	0	0			
Additional works for enlargement of infirmary department	1,[illegible]16	0	0			
				24,880	16	11
				£27,[illegible]	1[illegible]	5

The next paper is the Life of the late Mr Morrison architect of Dublin. We learn from the memoir that William Vitruvius Morrison was a kind of hereditary architect, his father, grandfather, and great grandfather having also exercised the profession. Sir R. Morrison, the father of William, and under whom he was brought up, is also a subject of the memoir. William Morrison, according to this paper, was the first to introduce the Tudor style into Ireland in modern days, and was the designer of a number of the finest modern seats in Ireland, principally in the style just named.

We next have four plates of stained glass windows, selected from the ancient churches of York by Messrs Bell and Gould, architects. The plates are beautifully printed in colours by Mr. Cheffins, and have a very rich effect. The concluding paper on the Primitive Churches of Norway, with six drawings of doors, with carved frames and frontispiece in wood, highly ornamented, and of a peculiar arabesque character, are well deserving the study of the architect; and, as the author observes, they afford hints and ideas that might be turned to account, and, among other purposes, for ornamental metal work.

Ecclesiastical Architecture. Illustrations of Baptismal Fonts. Part I. London: Van Voorst.

The present ecclesiastical fever will do some good if only for the interest it excites in architecture and its details. Parsons are looking about them, brushing off the whitewash, and brushing up antique fonts, pulpits, screens and pews, a zeal which we hope will also be caught by the Church Building Commissioners. The old rule was when one of the large workhouse buildings, misnamed churches, was run up, to stick in a few sheep-pens or pews, and consider the job completed. Attention to details, or the necessary ornaments, was not to be expected, the same ice-fiend ruled in cold propriety in the interior who had pared the outside to bare walls, simplicity, or as we should call it, nakedness, reigned supreme, and the carpenter and joiner finished tastefully what the bricklayer and labourer had so artistically begun. We hope, however, that the reign of the Goths is checked, and that we shall see better things. The present work will do much good in this respect, for it gives some excellent examples of what may be done in all styles in that neglected attribute of a church the font. The present number contains no less than sixteen engravings all by first rate artists, and produced with that excellence Mr Van Voorst knows so well how to display in his illustrated publications. We hope to see this work carried to a great many numbers.

RAILWAY WORKS—ABBOTT'S CLIFF, DOVER.

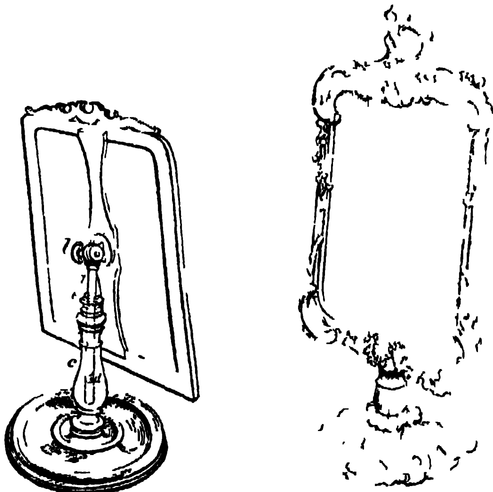
We are indebted to Mr Hodges engineer of the South Eastern Railway for the following details. Another of those blasts by which the progress of the works have been so greatly facilitated, and having for its object the clearing out the angle of the slope to form the face of the Abbott Cliff tunnel was intended to have been effected on Thursday, but from some unaccountable cause the circuit of one of the voltaic batteries was prematurely completed discharging a portion of the mines, and leaving the rest unsprung. In this blast (although minor in point of power, yet, as a piece of engineering much more difficult than any of the preceding) 3600 lbs of gunpowder were to have been exploded. This was divided into 28 charges varying from 28 lbs to 900 lbs each and placed upon two platforms 100 feet apart the upper having 12 and the lower 16 charges the whole of which were intended to have been simultaneously ignited. The arrangements had all been most carefully made by Mr Hodges assisted by Mr Graves and it is impossible to account for the partial and premature ignition which took place. So however it was. Some of the mines first exploded and Mr Hodges finding that to be the case completed the circuit of the whole of the batteries by which the 12 mines on the upper platform were discharged. Upon examination it was found that the spoil caused by the prematurely exploded mines, had disarranged the whole of the wires connected with the lower mines and, of course prevented their being discharged until this spoil could be removed. The dislodgment effected by the upper mines is precisely what was required, and there is little doubt but that the lower mines when discharged, will produce the desired result, although not fired with the upper. This partial check for it can scarcely be called a failure, is the first with which Mr Hodges has met in the course of the numerous explosions which have been planned and executed by him during the progress of the works, and by which so many thousands of pounds and so much time have been saved the company and contractors. Since the above was written, the lower mines were discharged, and the result is precisely what was desired by the projectors. The works are progressing here with great rapidity, the outward piles of the viaduct are now been driven and its completion will take place during the month. These piles go completely into a rocky substratum, and give great security and firmness to the work. The sea-wall is in a state of rapid completion and, when erected, will prove a most perfect barrier to the inroads of "Davy Jones," from whose attacks, such is the natural formation of the beach, we think there is nothing to be feared. The Archcliff fort Tunnel will be finished next week, and the preparations are now being made for laying the permanent rails in the Shakspeare Tunnel. According to appearances at present we have little doubt that Mr Cubitt's expectation of opening the line to Dover before the end of next month will be realized; at all events we feel quite satisfied that the year 1843 will witness the carriages of the South eastern Railway running to Dover.—*Dover Telegraph.*

NEW INVENTIONS AND IMPROVEMENTS.

BIELEFELD'S PATENT DRESSING GLASS STAND.

In the construction of glass stands every kind of form has been given to the frame and pillar supporting them but it is somewhat remarkable that no attempts have been made to improve the principle of construction in seeking graceful forms we appear to have hitherto forgotten to inquire whether the *mechanical* structure may not be improved, a circumstance the more remarkable, as the usual mode is admitted by every one to be very faulty. The glass in all cases hangs on two stems and turns on two pins after leaving the workman's hands, for a few days or weeks the glass turns obediently to our will and returns the desired angle but soon a little obstinacy shows itself, the glass seems bent on resuming its vertical position a turn is then given to the screws to keep it in its place again another and another turn gives us a brief control over the pertinacious mirror, but it is soon found that every turn of the screw increases the evil, for, in pressing against the glass, it mechanically forces the stem which holds it out of its proper upright position, and thus it is at length compelled to leave the glass, and take its own course, or to endeavour to resist it by wedges, props, or other shifts. Never yet, however, has this difficulty been overcome, for by some strange oversight, inventors have never sought a new principle of hanging. Mr Bielefeld, however, the inventor of the article before us, which he calls the *Quaquaversal* Glass Stand, has at length adopted the right course with complete success.

It will be at once seen that the simple stem which holds up the mirror can be raised or lowered, so that it may be used either sitting or standing, that the mirror itself can be turned to the right or the left, and set at every possible angle and it is also obvious that the screw which keeps the joint tight can never cease to do so, as it acts on a principle the very reverse of the screws on the old plan. The accompanying figures and description will explain the construction.



Description. — *a* is a simple stem, sustaining the mirror, which can be placed in a more or less vertical position by means of *b* a joint fitted with a thumb-screw, to admit of being tightened or loosened at pleasure. *c* is a hollow shaft, or column, in which the stem *a* is made to slide freely. *d* is a felt collar, fitted on the end of the stem *a*, to ensure an equal bearing on the hollow column. *e* is a collar, turning freely on the hollow column, and is fitted with a screw stuffing box, which allows the mirror to be fixed at any degree of elevation, and at the same time admits of its being turned either to the right or to the left. *f* is the foot, which is made to screw off or on, by which means it may be packed in the smallest possible compass — a great desideratum in exportation.

ARMSTRONG'S HYDRO-ELECTRIC MACHINE.

This machine which, under the above name, is attracting crowds of admirers to the Polytechnic Institution, is an apparatus contrived by Mr Armstrong (an enthusiastic scientific gentleman of Newcastle) for the purpose of collecting, on a large scale, the electricity generated by the friction of partially condensed steam. The vivid streams of electric fluid which are drawn from every part of the machine, and which appear almost inexhaustible, fill the reflective beholder with a mixed feeling of awe, of pleasure, and of pride, of awe at beholding so vast an accumulation of a power so fearful—of pleasure, at its novelty and beauty—and of pride, that man has attained the power of making subservient to his will, this mysterious agent, apparently more concentrated than the forked lightning, one shock of which, if passed through his body, would stretch him a lifeless corpse. The victory of mind over force is indeed daily extending, whether it be exercised over beasts or the elements, whether steam or electricity.

This discovery, like many others which are now changing the pursuits and opinions of men is of very recent origin, bearing date but two or three years ago. It appears that an attendant to a fixed engine at Newcastle, whilst standing in a current of steam rushing from a leaky valve in the boiler, extended his hand towards it, and perceiving a slight spark, concluded that the boiler was full of fire. Mentioning his suspicions to Mr Armstrong, the latter tried it, and from thence proceeded with experiments, which have ended in the production of the present machine. It is said that from the fall of an apple, Newton worked out his beautiful theory of gravitation—that the swinging of a lamp in a cathedral, suggested to Galileo the laws of the pendulum—and although we would not put this new discovery on a par with these, yet it is of the same nature. Thanks to the wide diffusion of scientific knowledge there are now multitudes of minds who imbued with true philosophic zeal, beholding an accident or an isolated experiment, which formerly would be viewed with the eye of superstition or considered as the result of chance and unaccountable, would immediately consider its cause and effect, and see in what manner it might assist in the advancement of science.

Description.—It may be considered to consist essentially of three parts, a boiler 7 ft by 3 ft from which the steam passes, by two tubes in the top, into the 2nd part, a long horizontal tube [illegible] which issue 40 curved pipes, terminated by wooden nuts with orifices $\frac{1}{8}$ of an inch allowing high pressure steam, mixed with a great quantity of condensed water to rush upon the 3rd part, the conductor which is composed of four rows of brass pins contained in a zinc box, 7 ft long by 1 ft 10 wide. The boiler is insulated by standing on six strong glass legs, the funnel is suspended, and when the machine is in action is raised up the conductor in electric communication with the earth.

Theory.—It appears from the investigations of Dr Faraday, that no portion of the electricity is due to the steam it acts only as the driving power to the particles of water which are condensed in the curved pipes. That in fact, it arises from the particles of water, rubbing against the small orifice from which it rushes. Positive electricity is excited, which the conductor instantly carries to the earth, the water then, in order to return to its normal state robs the boiler of its share, and leaves it in an intensely negative state. Thus we see, that although derived from a new source, we have not to add to the list of thermo magneto, chemico, and frictional electricities, as the latter is quite sufficient to account for it. It may, indeed, be compared to the common electrical machine by considering the water to correspond to the glass, and the boiler and tubes to the rubber. The Doctor has shown, by experiments as simple as conclusive, that dry steam or air elicit no electricity, but that if either hold in suspension particles of liquids or solids, electricity is excited that in the case of water, it must not contain a conducting substance, or none would be obtained, and that if it contain oil, turpentine, or other resinous substance, it produces electricity of an opposite kind.

It appears strange the only difference between steam and water at 212 being the latent heat the former contains that electricity cannot be produced from both, and it would lead us to consider steam as being a definite compound of oxide of hydrogen electricity latent heat the latter being in a much weaker state of combination, and always being parted with before the electricity.

The reader is, we doubt not aware that Faraday discovered some years ago that carbonic acid gas by being generated in immensely strong vessels, may be compressed into a liquid state, that Thilorier discovered that, if this liquid be allowed to rush into the air part of it passes into the state of gas and, by the cold produced, freezes some of it into the solid state. Now it would be an interesting experiment to ascertain if by insulating the apparatus, electricity could not be collected. The circumstances appear so similar, that we feel convinced that such would be the case. We should like to hear of Mr Addams who has greatly improved upon Thilorier's apparatus, whether he has tried it and if so, what is the result.

The exceeding beauty of the experiments performed by this machine is very striking. Water and other liquids have been decomposed by it, and every day beyond the ordinary experiments with tin foil and wires in various shapes, gunpowder is exploded, and shavings ignited, and the aurora borealis imitated most splendidly. Metallic leaves and wires are exploded by discharges from the large battery, which is charged six times in one minute. Although the battery can be charged in one-fourth of the time by this machine that it could be by the colossal plate machine that was used formerly, showing therefore four times the intensity, it appears that the striking distance, that is, the length of flash is not anything like so long.[1]

Mr Bachhoffner, who gives an exceedingly clear lecture on the machine, drew attention to an interesting spiral movement in the electric fluid which occasionally takes place in the aurora experiment which cannot be accounted for. We think it may possibly have some connexion with a fact which we noticed that, although the apparatus is not shifted at all, yet the discharges do not take place in the same spot, but are always shifting it may be because the electricity does not arrive at the same degree of tension on the spot where a discharge has just taken place.

[1] On closely inspecting the paper on which the metal was exploded which was kindly given to us by Mr Bachhoffner, the coloured streaks which are left were found, in several instances, to be composed of an infinite series of finer lines, placed at right angles to the general streak showing, that at the time of the discharge they were converted into temporary electro magnets.

We think the proprietors of the Polytechnic Institution deserve all the success they are reaping for the spirited way in which they are bringing forward all new scientific discoveries, and may, with great confidence, recommend our readers both scientific and otherwise, to witness the splendid effects of this new machine.

PREPARED PAINTED SURFACES OF PAPER.

HENRY MARTIN, of Norton-terrace, Camden town, painter, has obtained a patent for "*improvements in preparing surfaces of paper.*" Patent dated March 30, 1840, they consist in embossing and enamelling the surfaces of paper, and in manufacturing paper hangings. A coat of oil paint of the desired colour, is first applied to the surface of the paper, as evenly as possible, with a common paint-brush, it is then rubbed lightly over with a brush, similar to a clothes or shoe-brush, (giving it a circular motion) to remove the marks of the paint-brush, after which, an additional smoothness is given to the painted surface, by passing a dry brush, called a "softener," lightly over it. If more than one coat of paint be laid on, this process is repeated. Or, instead of the above method, the paint may be applied by conducting the paper between two rollers, together with an endless felt or other fabric, which is supplied with paint by passing under a roller, partly immersed in it, the superfluous paint being removed from the felt, as it ascends by a scraper. The paper, thus prepared, is embossed, by passing it between engraved rollers or dies, or is converted into paper hangings by printing the required designs upon it with blocks or other surfaces. If a glazed or enamelled surface is to be given to the paper, the oil paint must be used in a thick or round state, and thinned only with turpentine, in the same manner as if it were used for "flatting." When the turpentine evaporates, the colour becomes set, the paper is then placed upon a bed of woollen cloth or other soft material, and a pallet knife or trowel, with a polished surface, is passed over the painted surface of the paper, with a slight pressure, the colour being set yields to the pressure, and a glaze is thereby produced, which may be afterwards heightened in the usual manner. Other means may be resorted to for glazing the painted surface of the paper, if preferred.

RAILWAY CHRONICLE OF THE MONTH.

The Railway proceedings of this month have been principally confined to the results of the great amalgamation movement of last month. The influence of the Great Midland junction has been to produce the greatest effect on all the railway interests of England, by the creation of a new power with a new policy. The London and Birmingham, hitherto the ruling line of the south, has been the first to feel the change. It is said that the Great Midland has made a proposition requiring the London and Birmingham to let them work their own traffic to London on the same terms as the Manchester and Birmingham do on the Grand Junction, under the penalty of having their own line from Leicester to London. The London and Birmingham have in consequence taken a bold step by bringing about an amalgamation or rather union of the Northern and Eastern and Eastern Counties so as to prevent these latter lines from falling under the power of the Great Midland, and assisting them in obtaining the trade of the north and east of England, while it is expected the measure will secure to the London and Birmingham the benefits of the Northampton and Peterborough line. It is most probable that these hopes of the London and Birmingham will not be fulfilled. The union of the two lines has taken place, meetings of each being held at the Shoreditch Station on the 25th, when resolutions were passed almost without opposition, approving of the plan, except that Mr D. W. Harvey, at the Eastern Counties' meeting made a speech two hours long. The plan guarantees 5 per cent dividend to the Northern and Eastern, the Eastern Counties to have 4½ per cent, and the remaining profits to be divided in the proportion of two thirds to the Eastern Counties and one third to the Northern and Eastern. The joint board to consist of twelve Eastern Counties Directors and six Northern and Eastern Directors.

The Devon and Cornwall Railway is progressing, two meetings having been held at Plymouth and Devonport on the 24th and 26th instant, at which Mr Saunders, secretary and chief superintendent, and Mr Brunel, chief engineer of the Great Western Railway, attended.

Two lines have been started as branches from the Eastern Counties Railway to Harwich, and the plan for the extension to Ipswich is being prosecuted.

A line has been brought forward to carry the mineral traffic in Lancashire ... to the Port of Foudrey; it will also form part of a West Cumberland line.

The Churnet Valley line has been revived. This railway would proceed from the Manchester and Birmingham Railway by Leeds to Derby.

Mr Rastrick is surveying for a Brighton Railway branch from Shoreham to Worthing and Chichester.

We ought to have mentioned above that an amalgamation is also on the tapis between the North Union Railway and the Bolton and Preston. Many parties justly fear that the ultimate result of amalgamation will be to throw all the lines into the hands of the Government. The French government, in defiance of the expression of public feeling on the General Railway Act, is trying to get the lines into its own hand in France. It is said they intend next session to ask the Chambers for her authority to work the Paris and Northern Railway and Montpellier and Nismes Railway. This, if successful, would also be an example for our parties here.

With regard to foreign railways, the great event has been the opening of the junction line between Liege and Aix-la-Chapelle. This forms a continuous communication of upwards of 200 miles from Cologne, on the Rhine, to Antwerp, Ostend, and Lille.

The Darlington Junction Railway has guaranteed the projectors of the High Level Bridge 3 per cent on the expenditure of £100 000, as a composition for toll on railway traffic. Messrs John and Benjamin Green are appointed architects and Robert Stephenson consulting engineer. The idea of employing wood has been abandoned, and either stone or wood will be the material employed. The capital is to be raised in shares of 20*l* each, and the estimate of the cost of the bridge is £80 000, a revenue from traffic of 8*l* per cent in addition to the guaranteed percentage is anticipated, notwithstanding which very few shares have been taken. The prospectus was issued last September, and John Hodgson Hinde, Esq, M.P., is chairman of the committee.

Another great event of the month, has been the decision in the important case in Chancery of Ranger *v.* *The Great Western Railway*, involving in itself and the cases depending upon it, upwards of a quarter of a million sterling, some say £400 000. This litigation has long acted to the disadvantage of the Great Western Railway Company. Mr Ranger and his advocates having been large in their demands and loud in their denunciations of fraud against the company and its engineers, particularly Mr Brunel's. The Vice Chancellor of England, Sir Lancelot Shadwell, in giving judgment by special appointment at Lincoln's Inn on the 27th, gave judgment on every point in favour of the company, dismissing the plaintiff's bill with costs, and declaring his statements to be devoid of foundation, at the same time that he vindicated the high character of Messrs Brunel, Frere, and Babbage. As to the plea that contractors were not to be guided by the decision of the engineer as to the mode in which the work was executed, the Vice Chancellor repudiated such a doctrine; he said it was of importance to the safety of mankind that railways should be executed under the directions of eminently scientific men, and that in the act of the Great Western Railway Company, the legislature had set an example, in declaring the opinion of the Surveyor General of Metropolitan Roads and of the Engineer of the London and Birmingham Railway decisive as to certain works, as to quantities and valuations, however application might be made to that court. He treated as nonsense the attempt to reject the decision of the engineer, because he was a shareholder in the company, it was notorious that engineers and other officers of railway companys were shareholders in them, and there could be no doubt the interest of the engineer was paramount to that of the shareholder. The Vice Chancellor, on the plaintiff's own showing, upheld the system of penalties for the fulfilment of a contract, as a wholesome system to insure the work being effectually and punctually executed, since the plaintiff himself had adopted the same system with his subcontractors, and on the same grounds. He also asserted the legality of the taking possession of the work and plant. In fine, the Vice Chancellor dismissed the bill on nearly every count, with costs, leaving the plaintiff to any remedy he might have at common law, and allowing an account to be made out subject to the penalties and conditions of the contract. This result was what was anticipated by most reasonable men, though Mr Ranger and his friends had buoyed themselves up to the last with the hopes of success. He will however very probably try to induce his creditors to appeal from this judgment, though it is not likely with any success. This decision is of importance, not merely on its technical grounds, but as it relieves the property of the Great Western Company from a *bearing* influence in the money market, secures the present management in office, which otherwise was in jeopardy, and leaves free scope for the exercise of the plans of extension entertained by the moving parties in the concern.

Midland Counties' Railway.—We are informed that the platform across the Trent was not carried away by the floods, as stated in last month's *Journal*, but was removed at the latter end of August, in consequence of the Weir being finished.

ENGLISH AND BELGIAN COKE.—For the comfort of the Newcastle coal-owners, and as a set-off to a paragraph depreciatory of the Newcastle coal, we have to mention that serious complaints have been made by all parties connected with the Paris and Rouen Railway, in reference to the Belgian coke which has been latterly used upon it. The *Journal of Rouen* states in a recent number that on the opening of the railway, and for some time afterwards, the locomotives were supplied with English coke, and all went well. The stock however became exhausted and recourse was had to Belgian coke. The trains immediately became seriously retarded, and the company has appealed to the Tribune of Commerce for damages against the merchant who supplied the Belgian coke—and surveyors have been appointed, in consequence, to estimate the damage.—*Gateshead Observer.*

THE GREAT NORTHERN STEAM SHIP.

This fine vessel, which was built by two or three spirited individuals at Londonderry, in the north of Ireland, and completed last year, arrived in the river Thames last January, she has since then, through some imperfection in her machinery, been laid up in the East India Docks, for the purpose of having her engines thoroughly examined and set to rights, to adapt them more particularly to the working of Mr. Smith's patent Archimedean screw; for this purpose, the owners placed the machinery in the hands of Messrs. Miller and Ravenhill, the well known engineers of Blackwall. We know of no one better qualified for such a task than Mr. Joseph Miller, his superior practical knowledge of all the details of the marine engine are well known to all persons throughout the world, who are in any way connected with steam navigation; this is farther proved by the very great satisfaction he has given to the owners, for the very perfect manner he has completed his task, which has been an Herculean one, when it is considered that he has had to alter engines of a large magnitude which had been made, not by one engineer, but by several, and in various parts of the United Kingdom, part having been made in Ireland, and other parts by different manufacturers in England. It now affords us much pleasure to say that at a trial of the vessel down the river Thames on the 11th ult., the engines performed all that could be desired; her performance against tide was fully equal to 7¼ knots per hour, her speed through the water may be fairly taken at 10 knots per hour; when we consider the disproportion of the power to the tonnage of the vessel, this is a most satisfactory performance, and shows that the screw is nearly equal to the paddle wheel in rivers, and superior in the open sea, particularly during tempestuous weather. It must be a source of great satisfaction to Mr. Smith, the patentee, to whom all the credit is due, for his persevering industry in bringing forward this new mode of propelling, in opposition to a whole phalanx of great men.

As the engines have undergone some alterations, we will proceed to describe them, together with their dimensions, and also those of the vessel.

There are two engines, which are placed immediately abaft the vessel, with the large spur wheel athwart, between the engines, and the boilers in advance of the engines, leaving the whole of the midships and fore part of the vessel clear; and we must here suggest the necessity of placing the saloon or principal cabin in the midships, so as to avoid the unpleasant noise of the cog-wheel gearing, which is very objectionable. There cannot be the slightest objection to it; for, if stowage be required, it might be placed in the stern and fore part of the vessel as well as in the midships.

The engines are of the direct action steeple principle, with cylinders 68 in. diameter, and 4 ft. 6 in. stroke placed in the centre of the breadth of the vessel, attached to the top of the piston rod is the cross head, forming the base of a triangle, to the apex of which is depended the connecting rod, working like a pendulum; the lower end of this rod is attached to a crank fixed on to the shaft of the large spur-wheel, a corresponding engine working a similar crank on the other side of the spur-wheel, which is, as before stated, placed between the two engines. There are two air pumps to each engine 19 inches diameter, and of the same stroke as the cylinder, worked by rods fixed at each end of the cross head forming the base of the triangle just mentioned these two air pumps communicate by passages with a single condenser placed in front of the cylinder, with the steam and exhaust valves between. From this description it will be seen that the power is applied direct to the large spur wheel, 20 feet diameter, (depth of cogs on the face, 23 inches, and pitch, 6 inches.) which takes into a pinion, below 5 feet diameter, fixed on the iron propeller shaft, 10 inches diameter, which is firmly attached to the screw propeller with couplings; the diameter of the screw is 11 ft., length fore and aft 5 ft. 10 in., and pitch 14 ft. From these dimensions it will be seen that, if the engines make 20 strokes per minute, the speed of the screw will be equal to 80 revolutions per minute.

The vessel is of the following dimensions, extreme length 247 ft. breadth of beam 37 ft. length between perpendiculars 222 ft., depth in hold 26 ft. 5 in. draught of water 18 ft., length of main mast 90 ft. foremast 83 ft., mizenmast 61 ft., length of mainyard 76 ft. and diameter 22½ in., she can spread the enormous quantity of 6700 sq. yds. of canvass; burthen B.M. 1750 tons; there are three decks, the upper one is entirely clear, excepting the forecastle, all the windlass and capstan gear being 'twixt decks; she is built remarkably strong, and is in every way a vessel that will stand severe service.

THE IRON STEAM SHIP "NIMROD."

This vessel was launched from the building-yard of Messrs. Thomas Vernon & Co, on 26th Sept. last. The following are the dimensions of the vessel:

Length from figure-head to taffrail..	200	feet.
do. between perpendiculars ..	180	„
do. of keel	175	„
Beam	26	„
Width over Paddle-boxes	46	„
Depth of Hold	16	„

and admeasures, old mode, 591 tons. This vessel is built for the City of Cork Steam Packet Company, who intend to sail her between this port and Cork. She being the 30th iron vessel which has been constructed at this establishment, many improvements have been introduced which experience alone can discover: she is adapted to carry a large cargo at a very light draft of water; and by her beautiful lines and model she is possessed of the qualities of an excellent sea-boat and fast sailer. The hull, rudder, paddle-beams, and deck-beams are made entirely of iron, and are of extraordinary strength. She is clinker-built to light water line, and double riveted on the longitudinal joints: above this line the plates are all flush. She has four water-tight bulk-heads, and divided into five water-tight compartments, the absence of which in other vessels has often to be deplored: the Pegasus, Solway, and Queen, which have so lately gone down, would no doubt have been saved had they possessed this improvement. The frames of this vessel are of strong angle iron, with sleepers, 15 inches deep across the bottom; the length of the fore-hold is 50 ft. 10 in. exclusive of a portion at the bow for chain lockers and use of the crew; and length of after-hold, 63 ft. 6 in. between which and the stern-post is placed a tank to contain water. The quarter-deck is 55 ft. long, from which the cabins are entered by a spiral staircase. The principal saloon is 41 ft. long and 8 ft. high; it is ornamented by Bielefeld's papier maché gilded mouldings, and, though not of the most splendid order, presents an appearance exceedingly neat and elegant; it is lighted from the deck by a skylight of considerable size and very chaste design: there is a separate cabin for the ladies, and one for the gentlemen, both neatly fitted up with every convenience for the comfort of passengers. The entrance-hall is pleasant and airy, and the steward's pantry compact and conveniently situated. The number of berths which can be made up is 50. She is intended to have three masts, rigged with Smith's patent wire rope, and is expected to be ready for sea this month. The keel was laid on the 6th of May last, so that the vessel has been built in the short space of four months and twenty days.

The engines, manufactured by Messrs. Bury, Curtis, & Kennedy, are of 300 H. P.; they are on the direct-action plan, with a much longer connecting rod than is generally obtained in direct engines, though they do not reach a greater height above the deck than that of an ordinary crank scuttle; they also occupy a very small portion of the vessel, the length of the engines alone being 9 ft., and width, 20 ft. 6 in., and the whole space occupied in the length of the vessel, including engines, boilers, firing-room, &c., is only 35 ft. 10 in.; the engine-room is thus so much reduced, that the capacity of the holds is increased at least 10,000 cubic feet for stowage above that which is generally obtained when engines of the side lever construction are used. They are of the following dimensions, viz.:

Diameter of cylinders		66 inches.
Length of stroke	5 feet	3 „
Diameter of paddle-wheels over the floats	21 „	6 „
Breadth of paddle-floats	8 „	6 „
Depth of ditto	2 „	7 „

The air-pump, which is double-acting and placed between the cylinders, is 37 in. diameter, and 2 ft. 7 in. stroke.

MISCELLANEA.

New Dock at Ellesmere Port. A commodious new dock, for the reception of shipping, has just been completed by the Ellesmere and Chester Canal Company at the terminus of their canal at Ellesmere Port. The opening of the dock for public use was celebrated on the 13th Sept. The works occupy three acres, and consist of a spacious dock, with wharfage, berths, &c., capable of accommodating a large number of vessels of 300 tons burthen. In connexion with the dock is an extended range of warehouses, four stories high, being 260 feet in length, and 45 feet wide; and which are connected with the dock by three wings, two stories in height, each extending in length 20 feet, and being 40 feet wide, and under which canals extend from the dock for the convenience of loading and unloading the vessels and boats using the canal and dock. The whole of the works, with the exception of the river wall, were designed by the late eminent engineer, Thomas Telford, Esq., F. R. S., whose plans have been carried out under the direction of Mr. Cubitt. The works, which have been in progress for the last two or three years, were conducted under the able direction of Mr. Provis, the contractor, at a cost of £100,000, and are a masterpiece of architectural and engineering skill.

The *National* states that the Government had commenced the construction of buildings near Vincennes which would cover beyond 300 acres of ground, and were intended to contain a model foundry and complete arsenals, with barracks for a considerable force of infantry and cavalry. "These works," adds the *National*, "have been undertaken without the authority of the Chambers, and the expense of the construction is estimated at 45,000,000 f."

Cornwall.—The Town Council of Truro have selected the designs of Messrs. Cope and Eales of Bloomsbury Square, for the New Stannaries Hall, Town Hall and Markets about to be erected there. There are two façades in the Italian style of architecture, one facing the river and forming an approach to the Fish Market. The buildings are to be executed in Granite at a cost of about £7000. The second premium was awarded to Mr. E. W. Elmslie of Carlton Chambers. The Town Hall and Markets at St. Anstell, also designed by Messrs. Cope and Eales, are rapidly progressing, and will probably be completed by the ensuing spring.

MR STEWARD'S NEW IRON BEACON FOR THE GOODWIN.—Her Majesty's steamer *Tartarus*, Captain Bullock, R.N., arrived in our roads on Saturday last for the purpose of taking off and planting on the Goodwin Sands an iron beacon invented by Mr Steward, and constructed upon the principle of the ponderous footed pile, which is the great novelty in Mr Steward's plan for the formation of a harbour of refuge. On Sunday afternoon Captain Bullock having communicated with Mr Steward as to the best course of proceeding, the *Tartarus* sailed for the Goodwin, to fix a buoy at the spot appointed by the Hon. Trinity Board for the erection of the beacon. On Monday the *Tartarus* returned to our bay, having been prevented by the heavy surf on the Goodwin from fixing the buoy. After a stay of a few hours the *Tartarus* again steamed off for the Goodwin, and returned to Dover on Tuesday morning, accompanied by the large lighter No. 1, from the dockyard, to take off the beacon. For this purpose the *Tartarus* having upon each visit received the usual flag honour from the castle and heights, entered the harbour, and being a very fine vessel, upwards of 500 tons, she was an object of no small attraction. On Wednesday morning arrangements having been made for shipping the beacon on board the lighter, half of the shaft, with the ponderous foot, was lowered from the Ordnance crane, when it was unfortunately found that the boat was unequal to the weight of this part of the beacon, on account of the position in which it was necessary to place it. It was then considered the best plan to procure from Sheerness a chain lighter, and the *Tartarus* left the harbour on Wednesday afternoon and proceeded to Sheerness for that purpose. She is expected to return in a few days to complete her task, and place Mr Steward's beacon on that grave of thousands, the all devouring Goodwin. May success attend the indefatigable exertions of the worthy inventor! The beacon was cast by Messrs Poole and Co. of this town, and we shall give a description of it in a future number. The active co-operation of the Admiralty must be highly gratifying to Mr Steward, as it ought also to be to the public in general, evidencing, as it does, the readiness of the Government to promote all plans of merit projected for the safe guidance of the wooden walls of old England and the preservation of their brave crews.—*Dover Telegraph.*

IMPROVEMENT [illegible] October 11th [illegible] the fleet [illegible] the waterway [illegible] Mr Rennie [illegible] Mr Cubitt, Mr [illegible] and Mr Anderson, the late engineer to the corporation [illegible] Mr Brooks, [illegible] The [illegible] Mr Walker [illegible] engineer [illegible] the admiralty [illegible] Trinity House, shipowners and pilots [illegible] the Council [illegible] the proposed [illegible] at Deptford [illegible] Mr [illegible] consulting [illegible] to the Corporation [illegible] Mr Walker [illegible] to the whole question [illegible]

LAUNCH OF AN IRON STEAM VESSEL.—On the [illegible] from the yard of Messrs [illegible] Mill [illegible] called *Der [illegible]* of [illegible] dimensions [illegible] beam 20 ft. 3 in. [illegible] 150 tons [illegible] nearly 2 inches [illegible] and [illegible] the River Rhine [illegible] *D[illegible]* [illegible] that have been constructed [illegible] Mr [illegible] used as towing vessels on the same river [illegible] with [illegible] have completely answered [illegible] of the [illegible]

LAUNCH OF [illegible] QUEEN.—On [illegible] 2 the new iron steamer called the [illegible] was launched [illegible] of Messrs [illegible] of the Queen [illegible] Liverpool [illegible] the vessel, which is intended to carry [illegible] cargo between Calcutta and Singapore [illegible] about 300 tons [illegible] have engines of about 200 [illegible]

ENGLISH LOCOMOTIVE ENGINES [illegible] Information [illegible] exclusive of Austria there are running 1801 [illegible] of which Messrs Robert Stephenson & Co. [illegible] railway [illegible] Sharp & Co. [illegible] Rothwell 10 [illegible] 180 [illegible]

North Shields.—A new gas company [illegible] Borough [illegible] formed [illegible] with a capital [illegible] £6000 in shares [illegible] two hours [illegible] light the town on the terms offered by the company [illegible] 15s. per lamp per annum.

LIST OF NEW PATENTS

(From Messrs Robertson's List.)

GRANTED IN ENGLAND FROM SEPTEMBER 2[illegible] TO OCTOBER 21, 18[illegible]

Six Months allowed for Enrolment, unless otherwise expressed.

John Haydon Collier, of Goldsworthy terrace, Rotherhithe, Surrey, civil engineer, for "*improvements in the construction of furnaces and flues.*"—Sealed September 28.

John Ainslie Farmer, of Redheugh, near Dalkeith, N. B., for "*a new or improved mode of drying tiles, bricks, retorts and such like work, made from clay and other plastic substances*"—Sept. 30.

John George Briggs, of Leicester, coach proprietor, for "*improvements in axles*"—Oct 5.

Edward Banton, of Walsall, Stafford, saddlers' ironmonger, for "*improvements in saddles and horse harness.*"—Oct 5.

Richard Boote, of Burslem, Stafford, earthenware manufacturer's clerk, for "*improvements in pottery and mosaic work.*"—October 5.

Benedict Albano, of Piccadilly, civil engineer, for "*improvements in preparing materials and applying them to the manufacture of ornamental mouldings and other useful purposes*" (A communication.)—Oct 5.

James Combe, of Leeds, engineer, for "*improvement in heckling, cleaning, preparing and carding flax and other fibrous substances*"—Oct 5.

Ferdinand Charles Warlich, of Cecil street, gentleman, for "*improvements in the manufacture of fuel*"—Oct 5.

William Norton, of Stingate, Surrey, slater, for "*improvements in covering roofs and flats of buildings with slate*"—Oct 5.

Jonathan Saunders, of Soho Hill, Birmingham, gentleman, for "*improvements in the manufacture of types of railway and other wheels, and in the manufacture of railway and other axles*"—Oct 5.

[illegible] Griffin, of Withymoore works, Dudley, manufacturer, for "*improvements in the manufacture of spades, shovels, and such like tools.*"—Oct 5.

John Baptist Soldi, of Windsor-place, Southwark bridge-road, Surrey, for "*improvements in apparatus for measuring of persons' heads and for fitting and retaining hats, caps, and bonnets according to such measure*" (A communication.)—Oct 5.

Charles Brown, of Woolwich, Kent, surgeon, for "*improvements in the manufacture of dip candles*"—October 5.

Lawrence Hardman, of Liverpool, merchant, for "*improvements in machinery or apparatus to be employed in the manufacture of sugar*"—Oct 5.

John George Bodmer, of Manchester, engineer, for "*improvements in grates, furnaces and boilers, and also in manufacturing or working iron or other metals, and in machinery connected therewith*"—Oct 5.

Margaret Henrietta Marshall, of Manchester, for "*an improved plastic composition, applicable to the fine arts, and to useful and ornamental purposes*"—Oct 5.

George Wall, jun., of Manchester, gentleman, for "*improvements in the methods or processes of manufacturing earthenware, china, and other similar substances, and also in the machinery or apparatus applicable to such manufactures*"—October 5.

Philip Walther, of Angel court, Throgmorton-street, merchant, for "*improvements in the construction of steam engines*" (A communication.)—Oct 12.

John Cleaver, of Ripley, spelter maker, for "*an improved furnace for sublimating or reducing to a metallic state the ores of zinc*"—Oct. 12, two months.

Stephen Hutchinson, of the London gas works, Vauxhall, engineer, for "*improvements in gas meters*"—Oct 12.

Charles Brook, of Waltham mills, cotton spinner, for "*improvements in machinery for spinning and twisting cotton and other fibrous substances*"—Oct 12.

Moses Poole, of Serle street, gentleman, for "*improvements in card playing machine*" (A communication.)—Oct 12.

Stephen Gears, of Hamilton-place, King's-cross, architect and civil engineer, for "*improvements in the construction of panelling and framing, applicable to all building purposes, cabinet work, and other similar uses*"—Oct 13.

Richard Beard, of Egremont-place, New-road, Middlesex, gentleman, for "*improvements in printing calicoes and other fabrics*" (A communication.)—October 13.

Richard Eamon Nevill, of Llangennech, Carmarthen, Esq., for "*an improved mode of separating certain metals when in certain states of combination with each other*"—October 18.

William Watson, Junior, of Leeds, chemist, for "*improvements in ventilating houses and other buildings*"—October 18.

Julius Adolph Detmold, of London, merchant, for "*improvements in the construction and arrangement of furnaces or fire places applicable to various useful purposes*"—Oct 18.

James Graham, of Wapping, Middlesex, for "*improvements in the construction of pots or vessels, and furnaces used in the manufacture of zinc, and in other manufactures, and also improvements in the treatment of the ores of zinc in the process of manufacturing zinc*"—Oct 8.

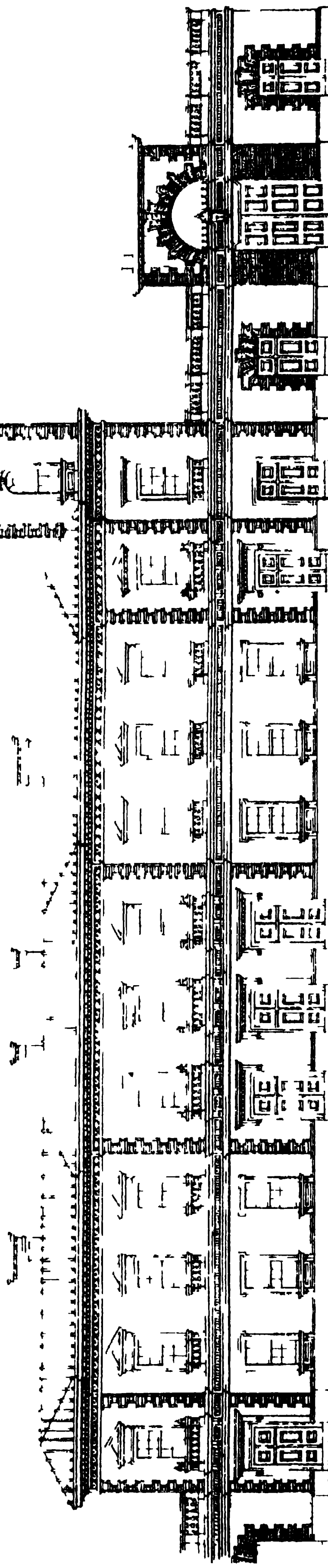
Thomas Morton Jones, of Birmingham, merchant, for "*improvements in heating liquids and aeriform bodies*"—October 18.

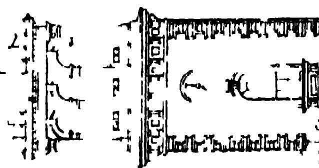
James Gibbons, of New Radford, Nottingham, machinist, and Thomas Roe, of the same place, machinist, for "*improvements in machinery used for what is called setting or reading patterns, and stamping or punching them in jacquard cards*"—Oct 21.

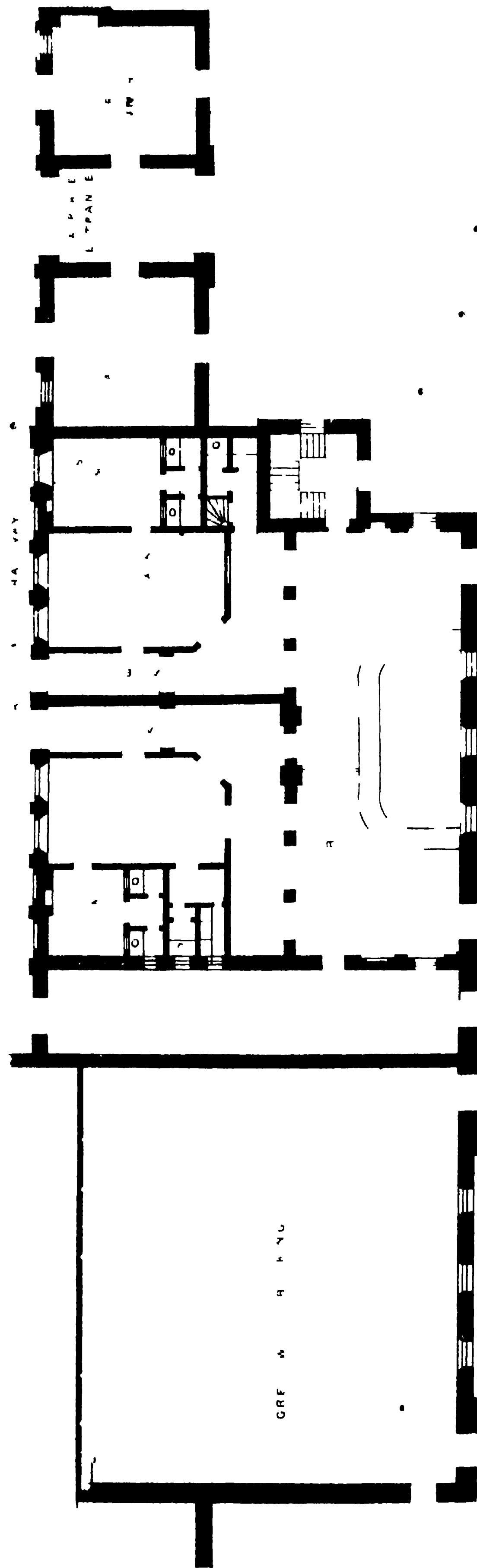
George Edward Mylne, of Albion-terrace, Canonbury square, Islington, watchmaker, for "*improvements in the construction of watches*"—Oct 21.

ERRATA IN LAST MONTH'S JOURNAL.

Page 356, column 1, line 6, for "*challenged*" read "*alleged*."
Page 366, column 2, the *Princess Alice* steamer, for "12 feet long" read "120 feet long," and in the [illegible] line from bottom, for "*this*" read "*these*."







THE NEW TERMINUS OF THE BRIGHTON, CROYDON, DOVER, AND GREENWICH RAILWAYS AT LONDON BRIDGE.

(With an Engraving, Plate XV.)

We have at length the pleasure of presenting to our readers some particulars of the New Joint Railway Terminus at London Bridge, the extensive works of which have been in progress during the last 18 months, and are now all but completed, so far as respects the portion to be executed by the Brighton, Croydon, and Dover Companies; and our remarks are accompanied by a view of the entire façade, as it will appear when the Greenwich Company's portion of the building shall have been completed, together with a ground plan.

From the time of the passing of the Acts of Parliament for the construction of the Brighton and Dover lines of railway, it became evident to the Directors and Engineers of those undertakings, that the Croydon terminus at London Bridge would be found not only totally inadequate to the carrying on of the united traffic of these lines of railway, but that its position to the north of the Greenwich station was inadmissible, involving as it did the inconvenience and danger of crossing the Greenwich line of railway at the departure and arrival of every train: and in due time arrangements were accordingly entered into with the Greenwich Company, by which the original Croydon station was made over to them in exchange for the original Greenwich station, together with an extent of new works on the south side thereof of equal area, by this arrangement, combined with the widening out of the Greenwich viaduct from the Croydon junction to the terminus, from which point four lines of rails are now provided, the Greenwich traffic is kept entirely distinct, and to the northward of that of the Brighton, Croydon, and Dover lines: while by a happy agreement between the four different companies, assented to on the part of the Greenwich company, by the advice of their talented architect George Smith, Esq., a complete unity of design has been preserved in the entire façade, as seen from the approach from Duke Street.

The whole extent of surface now occupied by the joint station, is 130,000 square feet, or about three acres. And when it is considered that the whole of this extensive surface has of necessity been raised by massive piers and arches to an average height of about 23 feet above the natural surface of the ground, some idea may be formed of the magnitude and cost of these works, in which, exclusive of the old Croydon and Greenwich terminus, above 8,000,000 of bricks have been consumed.

On entering the station the spacious and elegant iron roofs attract notice, the surface covered in by this means includes an area of 48,000 square feet, or upwards of an acre, affording ample scope for housing and cleaning the numerous carriages of the different companies, and securing from the weather the spacious arrival and departure platforms, and the space to the south appropriated to carriages waiting the arrival of trains.

These roofs are supported by three rows of cast iron fluted columns, of elegant design, connected together above their capitals by ornamented arched ribs, which carry the trusses of the roof; the rainwater is received into cast iron gutters communicating with the columns, which being cast hollow, convey away the water to the pipes and drains of the substructure. In the construction of these roofs, Mr. Rastrick has observed the same peculiarity of form in the struts as he employed at the roofs of the terminus at Brighton, but in this case, instead of being of wrought iron tubing, they are of cast iron, hollow, and fluted to harmonise with the fluting of the columns, and the nuts at the end of the king and queen rods are concealed by ornamental foliated pendants. The whole area is well lighted by skylights on either side of the ridge, running nearly the whole length of the roofs, and numerous others in appropriate situations.

The arrival and departure platforms, each 21 feet in width, are fine specimens of Bangor slate paving, in slabs, averaging 6 feet 6 inches by 4 feet each. On the arrival platform is a travelling luggage enclosure, deserving of notice, as being well adapted to its purpose, and less unsightly than such contrivances usually are.

To avoid confusion, a back entrance to the station has been provided by means of an inclined plane, commencing at the south end of Joiner's Street, by which cabs and omnibusses are allowed to enter and wait the arrival of trains, by which means the inconvenience of the confined space in front of the principal entrance is very much lessened.

The goods warehouse stands on the east side of Dean Street, communicating by a bridge with the spare carriage house on the west. The cranes for hoisting and lowering are worked on the pneumatic principle, by a small steam engine placed under the tank, which supplies the station with water.

On referring to our engraving, it will be seen that the advanced portion of the façade consists of a centre, in which are three doorways, and two wings with a doorway in each, that in the right wing is the first class passengers' entrance to the booking offices, the right hand door of the centre is the second class entrance, and the centre doorway is the way for luggage, and the remaining doorways are the first and second class entrances to the Greenwich company's offices. Receding from the principal front on the right is the campanile rising to a height of 97 feet from the level of Tooley Street to the summit of the vane, and exhibiting an illuminated clock for regulating the times of the arrival and departure of trains.

Still further removed from the line of the principal front are the offices for the arrival and departure of parcels, (forming the extreme wings of the façade,) united by a lofty archway, which serves as an entrance for gentlemen's carriages departing by the trains. The interior of the building contains on the ground-floor the general booking office 53 feet by 21 feet, with separate entrances, passages and waiting rooms, for first and second class passengers, so arranged, that the two classes are kept distinct, until they arrive at the platform, to effect which objects, the arrangements seem well adapted. On the one-pair floor, to which we ascend by a stone staircase in the tower, there is a large room for the public meetings of the companies, and three others for the use of the joint station committee, secretary, &c., besides the apartments of the housekeeper, a secondary staircase from this part of the building leads to the clock room, in the upper floor of the tower, and above this to the lead flat, at the level of the principal cornice, from which, between the arches of the upper part, an extensive view of the metropolis and its southern suburbs is obtained.

To carry out their object, the committee availed themselves of the professional services of J. N. Rastrick, Esq., and W. Cubitt, Esq., as their joint engineers, to the judicious counsel of whom they are mainly indebted for the amount of accommodation secured in so confined and difficult a situation.

In the architectural department, Mr. Henry Roberts has been generally consulted, the designs being prepared, and the works more immediately superintended by Mr. Thomas Turner, the resident architect and engineer, and we deem it due to the taste and talent of the latter gentleman to state that we are indebted to him for the elegant Italian composition represented in our engraving.

We remember, that in the competition for the new Infant Orphan Asylum, the second premium was awarded to Mr. Turner, and we think his present effort entitles him to be considered as one of the rising architects of the day.

OBSERVATIONS ON ARCHITECTS AND ARCHITECTURE.

By Henry Fulton, M.D.

No. 3.

The Institute of British Architects is making a collection of all the editions of the works of Vitruvius. As soon as this collection shall be formed, which ought to contain as many copies of each edition as

possible, the entire, together with all the works of Palladio and Sir William Chambers that can be procured, should be piled together and burned, and the ashes collected after the manner of the ancients and deposited in a suitable urn, and let the spirits of these mighty authors rest in peace. The Institute is in the habit of giving medals and prizes for essays; it would be well to give a medal for the best essay on the propriety of such a sacrifice at the shrine of architectural taste. Although the destruction of these works would not destroy the existing memorials of them, nor yet perhaps work out much improvement in the taste of those architects who are grown old in the love of them, yet the advantage to the rising generation would be great, and a new order of things would arise.

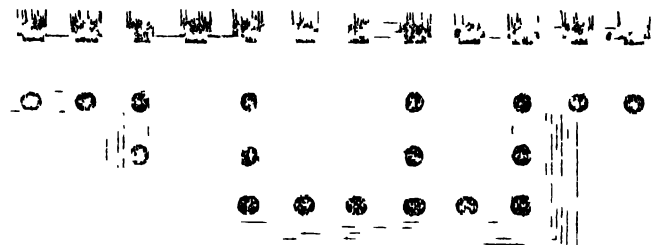
There is a ROYAL ROAD to a correct taste in Grecian architecture and every other style, (except, perhaps, the Gothic,) it is the straight and consequently the shortest road to excellence, it is comprised in this AIM AT CHASTENESS, UNITY, AND SIMPLICITY; ornament as highly as you please, embellish as elaborately as you can, but still recollect that all must harmonise with chasteness of composition, unity of design, and simplicity of character such are the features to be recognized in the rude remains of Possidonia, and such is the character of the highly finished, though ruined and despoiled edifices at Athens. This road will lead us to study the best proportion; will lead us to be more anxious with regard to the quality than to the quantity of ornament. There are few things which distinguish a civilized from an uncivilized people more than the love of displaying extravagant ornaments on their persons, particularly the softer sex; our own lovely countrywomen set off their beauty and show their sense by a few but well selected ornaments; others, not so highly gifted in person, but making up for that deficiency by good sense and taste, use no ornament which can make them remarkable, and others again, deficient both in mind and person, show the first in attracting observation to the latter, by a display of too much ornament. Does, or rather did, the gilding of the nondescript cages, which surmount the National Gallery, redeem the want of chasteness, unity, and simplicity? By the way, these cages ought to be removed to the Zoological Gardens.

In pursuing our journey by the royal road, we shall not be tempted to seek for variety for the purpose of "relieving the eye." Vitruvius gives us his theory of the proportions of columns as to that of the human figure, this is sheer nonsense, but it is not nonsense to observe that in the human form there are no breaks, no angles except those necessary for some purpose in the economy of our being. How well the Greeks understood the appropriate manner of relieving the eye, may be seen from an inspection of the Elgin marbles, the figures of the pediment, intended to be raised far above the point of vision, are in high relief, those of the metopes, which were nearer, are in a lower relief, and those of the frieze of the pronaos still lower, because intended to be seen directly from beneath; had they projected, the effect would have been anything but pleasing. The architects of the interior of St. Peter's understood the effect of due proportion well — the figures with which it is ornamented are increased in size in proportion to their elevation, and hence in optics the most perfect unity of proportion is obtained. To a want of the consideration of this may be imputed the poverty of our crowning cornice, and the necessity which is improperly created for the use of those hideous balustrades on the tops of our edifices man dislikes monkeys, they imitate humanity so abominably—and the quadrumana themselves, as they rise above each other in the scale of intelligence, shun the society of those below them: the horse abhors the ass, because it is a caricature of himself and if columns were animated they would reject all association with balusters; but although they cannot speak, the effect produced shows us the incongruity.

An architect should be in his line what Raphael was in painting, not the pupil of Perugino, nor the disciple of Palladio, but the scholar, whose mind should be enlighted by a ray emanating from the works of Da Vinci or the ruins of a Greek temple. And here we may observe, that as Raphael did not think it necessary to copy the works of Da Vinci, in order to arrive at the excellence which he attained, neither is it requisite to copy the works of the ancients, provided the same principles guide the modern architects which enabled the ancients to produce theirs.

Greek and Latin are called dead languages, and any author writing in them must, to write well, compose in the style of those authors who are considered to be classical; the ideas of the modern writer may be new, but the style and construction are old; so it is with the Greek, Roman, and Gothic styles of architecture. We may, indeed, invent a new order or style out of these, just as French, Italian, and Spanish were formed on the root of Latin, after it was barbarised by the Goths and Vandals; but the new style so invented will require to be refined and polished, as those languages were in the hands of men of master minds. Without, therefore, asserting that the door for change and improvement should be considered as closed to us, it is folly to require architects to give a composition in any particular style, and at the same time say that they are not to be bound down by the rules which governed those who invented the examples from which we learn it. The lovers of pure architecture have some consolation when they see many of the edifices which are every day served up to them, for they may hope that even out of absurdity itself (and we have enough of it), good may eventually arise in the shape of a new style, as I have, in former papers, endeavoured to show that the Gothic did out of the debased Diocletian.

In the last number of this *Journal*, page 376, a ground plan of the proposed facade for the British Museum is given; I freely confess that it promises better than anything which I feared was to be given to us; and I have no doubt the drawing of the elevation will appear strikingly magnificent; but, let Sir Robert Smirke remember and let the public understand, that the building itself must have a very different effect, for the porticos of the wings being seen first and nearer to the eye than that of the recessed centre and principal one, will appear colossal in proportion. In one of two ways, and with the same number of columns, this might be obviated. First, by making the centre a colonnade (without any pediment) with steps on the three sides, and adding another column to the depth of the front of the wings, or, secondly, by arranging the columns of the centre portico after the manner of the Roman Pantheon—thus:



There are two errors of the press in my last paper, page 371 column 1, lines 41 and 65, for "*works*" read "*crocks*," and for "*unlessed*" read "*undraped*," the season is too cold for dress being dispensed with, better to wait until "the wind shall be tempered to the shorn lamb," before we request the Palladian architects thus to exhibit on the raking cornices of the window pediments in a *dos a dos tete a tete* position as designed by the great Maestro.

ON THE QUALITIES OF TIMBER AND DEALS.

On the several species of Fir Timber and Deals supplied to the English Market, and their respective qualities for the purposes of Building. Read at the Royal Institute of British Architects, Nov. 20, 1843. By GEORGE BAILEY, ESQ., Hon. Sec.

In the practical part of the profession of an architect, and especially in those branches which occupy by far the greater portion of the time and labour of most of us, the security of our foundations is certainly the most important object to which we have to direct our attention,—the second in importance is undoubtedly the choice of our timber.

The properties of the various descriptions of wood coming under the denomination of timber—their relative strength and durability—their fitness for the various purposes of building, with regard to their stiffness in different situations and under different conditions, have all been treated scientifically and practically, in a manner highly useful to the architect, and the results have long been in our hands.

The attention of the profession has even been called both in ancient and modern works, to the planting, growth, and felling of timber, and the varieties which local circumstances and soil may produce in the same species. That information of this kind is in the highest degree useful to the architect, and indeed indispensable to be known, is not to be doubted, and the important practical results which may be derived from inquiries strictly scientific, must be familiar to all of us, who, on a former occasion, have had the pleasure of listening to the Botanical discourses of our friend Dr. Dickson. But in the ordinary routine of our profession it is seldom, comparatively speaking, that we have to refer even to the original principles from which our practice is derived, and still less to questions connected with the organization and natural history of timber trees.

The architect, in fact, has seldom any connexion with the choice or conversion of his timber beyond certain limits. His choice is restricted to such qualities of timber, of such length and scantlings as he can find in the *market*, and on this point less information has been placed in the hands of the architect than any other connected with this subject. It has been thought, therefore, that a few words on the qualities of timber, to be found in the market as imported from the Baltic and from America, might not be unacceptable to the meeting. We will begin with European timber in the log, then proceed to American timber, and afterwards to the subject of deals.

BALTIC TIMBER.

Memel Timber.—The largest supply of square fir timber brought from any part of the Baltic to this country at the present time is from Memel. It is divided into three qualities—the best, termed crown, the best middling, and second, or brack Memel.

Of the first quality little comes to the London market, but a considerable quantity to the outports. It is of admirable quality and manufacture, nearly as clear of knots as the Riga timber, but not quite so close in the grain, nor so rigid, nor so durable: the more free it is from knots, the more liable it is to be shaky at the core. The knotty timber is less liable to this defect at the heart, because the knots serve as bolts through the timber to keep all the parts together. Crown Memel timber is usually somewhat more than 13 inches square, and the best of it is from [illegible] to 55 feet long, that which is longer being usually knotty at the upper extremity. The best middling is the highest quality of Memel timber commonly imported into London. Much likewise of the second middling or brack timber comes to the London market. The chief defect of this quality of timber is that it contains large knots which renders it unfit to be cut into small scantlings.

Dantzic Timber.—Whenever squared fir timber of great length and size, coupled with durability is required, the Dantzic timber is to be employed. On the average, Dantzic timber is the longest and largest fir timber that comes here from any port in the Baltic. It may be procured, upon order, as much as 70 feet long and 16 inches square—it commonly runs 14 or 15 inches square. The cheaper sort of brack timber has the defect of being full of large knots, the best middling is knotty in a moderate degree, but the crown Polish-squared Dantzic timber, that which has been squared in the province where it was felled, may be considered, upon the whole, the very best timber that the north of Europe supplies,—next to that of Riga, it is the most durable of fir timber.

The timber from Pillau, Konigsberg, and Stettin resembles that of Dantzic, but is rather coarser in the grain and more knotty. that of Stettin, though not very long, is sometimes of very large size, as much as 20 inches square.

Riga Timber.—Riga used formerly to be the port from whence almost all the fir timber in the log, from 12 to 13 inches square required in this country for building purposes was imported. As timber in the log, it is peculiarly applicable for beams, girders, and joists, being very rigid, and bending little under great weights; it is, moreover, very regularly squared, very straight, clear of knots, straight in the grain, and very durable. Owing to its rigidity and freedom from knots, it is, however, more liable than some other timber to the defect of being rent and shaken at the heart, for which reason the fir timber from other ports on the eastern coast of the Baltic is by many preferred for building purposes and less of this species of timber is consequently now imported into this country.

Formerly a considerable quantity of timber in the log was imported from Narva, St Petersburg, and Archangel, but scarcely any now comes from these ports—the St Petersburg timber is defective as being very subject to rend itself and become shaky as it dries.

Norway Timber.—But little timber and that of small scantling is now supplied from Norway, although at one time, large quantities were imported from Longsound, Porsground, and Brewick, but owing to the change in the mode of taking the duty some years since, by which the small timber of Norway was made liable to the same duty as the large timber from the Baltic (an exception being made only in favour of timber used in the Cornish mines), the importation of timber from that country almost ceased—it is now, however again making its appearance in the London market. Some of the superior Longsound timber is of an excellent quality, and is, perhaps, the most durable of fir timber.

The timber from Gottenburgh, Stockholm and Geflle is not usually well squared, seldom exceeds 30 feet in length, indeed is generally much shorter, and has, moreover, the bad property of rending and becoming shaky if kept in the state of the log so that unless immediately converted, it loses much of its value, very little, however, of this timber is now imported into England.

AMERICAN TIMBER.

The only description of American timber known in this market in the state of the log, are the *red pine* and the *yellow pine*—for although pitch pine has been brought here, *via* Halifax, from the southern ports of the United States, yet that species of fir timber is scarcely known in this country as an article of consumption, it is said to be extremely brittle.

Red Pine.—The red pine approaches very nearly in quality to Riga timber: it is almost as stiff and is free from knots, but the irregular manufacture and tapering of the logs occasion much loss in the conversion of the timber for use in buildings, the manufacture of this timber is, however, improving, and it is consequently rising in public estimation. It is the produce of Upper Canada and the adjacent portions of the United States, it is brought down in rafts from the great lakes (on the borders of which it grows), by means of the River St. Lawrence to Quebec, where it is shipped for England. Great caution is necessary in the use of this timber, if the voyage from Quebec was as short as that from Riga it would not, perhaps, be more liable than Riga timber to take the dry rot, but owing to the length of time that it remains in the ship, or owing to the yellow pine wood, which, as deals or timber is generally in the same hold with it, a cargo of red pine timber seldom arrives which does not exhibit, on some part or other of the surface of the logs, indications of the presence of dry rot, and therefore, although the timber, if not so treated, might not be liable to this defect, yet treated as it has been before it arrives here, it often is infected, and if then placed under circumstances only slightly favourable to the growth of the fungus, it will be the means of introducing the dry rot into a building, unless a closer examination be made of the surface of each log to be used than is usually done, or some means adopted to counteract the infection.

Yellow Pine Timber.—The yellow pine timber in the log comes from Quebec, from St. John's, from Miramichi, and from some other ports in New Brunswick. That from Quebec is not so fit for the better purposes to which yellow pine is applied as that of St. John's, nor is that of St John's so fit for those purposes as that from Miramichi. That of Miramichi is the lightest and most spongy, and the least fibrous of all. It is exceedingly mellow, to use the joiner's term, has

no tendency to warp, and preserves the form that the workman gives it. Yellow pine timber ought not to be used for rafters, joists, girders, or plates, in any building, for no purpose, in short, and in no situation, where strength and stiffness are required, and where the ends or any part of the timber come in contact with brick-work or masonry, or are liable or subjected to damp. Yellow pine timber is not rigid, it is deficient in strength; will break with a less weight than almost any other kind of timber; and, except in perfectly dry situations, or where it is thoroughly well ventilated, is extremely liable to take the dry rot

Deals, Planks, and Battens.

The first thing to be considered, as regards deals, is the quality of the wood. Many deals are of durable quality, and fit, on that account, for rough out-of-door purposes, and coarse floors or carpentry, but they are wholly inapplicable for fine joiner's work; for when the saw has passed through and reduced them to small dimensions, they warp and twist like a piece of whalebone. Deals of this character are termed by carpenters "*strong*." Such deals have likewise the bad property in general, of rending themselves to pieces as they dry, and become shaky. Deals that, when acted upon by the saw, do not form sawdust, but are torn into long strings or fibres, and, on that account, termed "*stringy*," are in general of this strong nature. Such deals are likewise less uniform in their texture, and vary more in the alternate fibres and cellular parts than the deals which are fit for the joiner. The deal to be good should have a certain degree of softness, easily yielding to the knife or chisel Such deals are to be distinguished by their light weight, in comparison with the strong fibrous deals, and when planed, they exhibit a silky texture. Some deals, and particularly the stringy deals, are very hygrometric, and never lose the property (however long they have been seasoned), of expanding and contracting with change of weather White Petersburgh deals are said to have that property The deal to be good should be straight in the grain, if cross grained, it generally becomes shaky diagonally upon drying, and falls to pieces under the saw, or, if cross-grained in a lesser degree, it does not yield a smooth surface to to the *plane*, but remains rough and fuzzy. The deal should, of course, be without coarse knots, and the more nearly it is perfectly clean the better. As to the manufacture of the deal, it should be square-cut, above all things, it ought not to have the centre or pitch of the tree left within it, since, where that is the case, the deal rends on drying. In yellow deals the sap, or albumen of the tree, ought to show itself only at the very edge of that part of the deal which was furthest from the centre of the tree. Deals are usually cut of three different widths, each of which has its appropriate name—those from 11 or 12 inches wide are called *planks*,—those from 8½ to 10 inches are called *deals*,—and those from 6½ to 7 inches are called *battens*.

Yellow Deals

Norway Deals.—The yellow deals of Christiania, in Norway, have always been considered to be of the very best description;—they are so in two senses—they are both durable and mellow, mellow meaning, soft, light, and fit for the joiner. Though soft, they are not wanting in a proper degree of stiffness. When properly seasoned, previously to being used, they remain (however minutely divided) precisely of the form that the joiner gives. This quality applies to the white, as well as to the yellow deals of Christiania—and to those above the deals of any other part of the world—and, therefore, the deals of Christiania will always be the material that the consumer will endeavour to obtain, if the price will allow him to do so.

Of late years the mode of taking the duty caused the deals to be cut in longer lengths than the timber would afford, so that inferior wood has been brought into the London market, and the high estimation and price diminished to a certain extent, it is said, however, that they are now rapidly regaining their former character.

The Yellow deals from Frederickstadt, in Norway, are very nearly the same in quality with those of Christiania, and generally obtain nearly the same price in the market. The white deals would be as good as those of Christiania, but for one defect, which is that the bark of the tree adheres to the knots, which, therefore, have a black ring round them, when the deal comes to be cut into board, a knot of this kind is apt to fall out. It may be observed that neither the deals of Christiania nor Frederickstadt are of as good quality as they used to be, particularly as respects the yellow deals

There are several kinds of yellow deals not quite so good as those of Christiania in the quality of the wood, and yet coming near to them, which formerly used to be imported from Norway in very large quantities, and still are imported from some of the places of shipment referred to, but to a moderate extent only. The principal of these ports are Longsound, Porsground, Larwig, Krageroe and Dram. The cloister deals from Longsound 2 inches thick, and the broad and clean deals from Krageroe 1½ inch thick and 14 feet long, were noted for their excellence From Dram, an immense quantity, both white and yellow, were imported, usually 10 feet long and 2 inches thick. The "lowland" deals from this port are of inferior quality, but the "upland" of superior quality.

Of the deals of most of the above-mentioned ports it may be said that they are good as regards the texture of the wood, but small in size, as they are seldom more than from 8½ to 8¾ inches wide Some few deals (principally white deals) used to come from Tonsberg, occasionally there was a considerable supply from Fredrickstadt and Moss, the yellow deals of those ports are of bad quality, and the white deals not much better Of the white lowland deals of Norway, in general it may be said that they resemble in quality the white spruce deals of America, they have the same tendency to warp and to rend on drying

Deals of Sweden.—The yellow deals of Sweden nearest in quality to the best yellow deals of Norway, as regards their being at the same time durable and mellow, are those which come from Stockholm and from Geffle in the gulf of Bothnia If Stockholm or Geffle deals were quite as mellow as Christiania deals, they would be preferred to those of Christiania, on account of their full size and freedom from sap, but they are somewhat more disposed to warp, and with regard to Geffle deals to have coarse knots There are some other ports in the gulph of Bothnia, viz., Hernosand and Sundswall, from which cargoes of yellow deals are shipped, occasionally little inferior in quality to those from Stockholm and Geffle. But it may be said of most of the deals from those ports, that in them there is in general an exaggeration of the faults perceptible in the deals of Stockholm and Geffle. A large portion of the deals from Hernosand and Sundswall are from 18 to 21 feet long and 10 inches wide The deals of Soderham and Schonwick are of a still harder and coarser nature than those last described. The yellow deals of Gottenberg although very free from sap, and durable, yet have the fault of being rigid and unfit for the joiner; they are, however, well adapted for rough purposes, both in and out of doors, on account of their durability.

Deals of Northern Russia.—The yellow deals of Archangel and Onega are very similar to each other in quality, and of all deals, they approach in one respect the nearest to the yellow deals of Christiania; they are exceedingly mellow, and fit for the joiner—on the other hand they are not very durable or capable of resisting damp, for which reason they ought not to be used in the ground-floor of a house; the knots are apt to be surrounded by dead bark they are imported of the average length of 20 feet. Archangel deals formerly were imported only of the width of 11 inches, or 7 inches, that is, in the state of plank or of batten, but more recently they have been imported of the width of 9 inches, and from the certainty of obtaining entire cargoes of the very first quality, without any admixture of inferior goods, (an object which could seldom be accomplished with regard either to Norwegian or Swedish deals,) these Archangel deals were made to supersede the use of almost every other superior description of European yellow deals. St. Petersburg and Narva yellow deals come of the breadth of 11, 9, and 7 inches in quality the wood is inferior to that of Onega or of Archangel. Petersburg deal is less durable and not nearly so mellow as either the Archangel or Onega deal, it is said to be nearly as liable to take the dry rot in a damp

and confined situation as the yellow pine deal of America. A few yellow deals are likewise imported from Riga.

The yellow deals from Memel and from Dantzic may next be noticed:—the former 11 inches, the latter 12 inches wide; both of these are very durable. Memel planks are well adapted for all rough purposes out of doors, for barn floors, and for the steps of stairs when clean; Dantzic planks are used by brewers and distillers for making the large vessels for holding the liquor, called backs. The very best of the Dantzic planks are likewise extremely fit for joiners work, as they are soft and mellow, and retain the shape, but this only applies to a small portion of them, and those which are soft, are not so durable. Dantzic likewise affords the long yellow plank 40 feet long, 3 inches thick, and 12 inches wide used for the decks of ships. Memel planks until of late years, were not imported in any large quantity.

There are likewise yellow deals from Finland; Nyland deals 14 feet long, resembling some of the coarser varieties of Sundswall deals, are of late introduction. The broad yellow planks 12 inches wide and 21 feet long from Biorneburg in the gulph of Bothnia, are of a quality very nearly approaching to the plank of Archangel, but far more knotty.

White Deals.

We now come to the *White Deals* manufactured from *Spruce Fir*, the yellow deals of Europe being manufactured from the *Scotch Fir*. All that has been said of the qualities of yellow deals applies likewise to white deals, except that the sap in white deals is not discernible from the heart, and therefore the manufacturer of white deals has so far one difficulty the less to contend with.

Norway is the only country from which white deals of the very first quality are imported in any quantity, for although the white deals from Stockholm and Geffle in Sweden, like the yellow from those parts, are very good, yet the quantity is too small to render them worth particular notice. The white deals, like the yellow, shipped at Christiania are the very best in the world, well fitted for joiner's work, being above all other deals of the kind, light and mellow. The white deals of Frederickstadt also are very good, yet rather subject to a small black knot surrounded by dead bark. All the other ports in Norway which have been mentioned as yielding yellow deals, supply white deals of good quality likewise; but from the smaller ports generally, the deals are somewhat narrow, (from 8½ to 8¾ inches wide,) whereas the deals of Christiania and Frederickstadt are full 9 in. wide; the narrow deals fetch a proportionately less price in the market. The white deals from Wekkeroe are sold by the name of Christiania deals, the least mellow and the hardest of which they resemble, they are of greater average length than the deals of Christiania, being perhaps of a mean length of 19 feet.

The Lowland white deals of Norway form the exception to the general good quality of the white deals of that country, the lowland white deals having most of the bad properties of the white spruce of America, that is a tendency to warp and to split upon drying. From Dram two qualities of white deals used to come, the upland and the lowland, the former as good in quality as the latter is bad, although it may be observed that both have of late years improved considerably. The white deals of Moss, though showy to appearance, are of this bad quality. Those from Longsound, Schien, and Larwig, are good. A considerable quantity of white deals have of late years been shipped from Gottenburgh—with few exceptions, they are of a hard stringy nature; the saw on passing through them tears their substance into strings instead of saw-dust. the white deals of the width of 11 and 12 inches from this port are, on account of their cheapness, one of the materials used by the makers of packing cases.

Russia.—Northern Russia exports hardly any white deals, although the few that come occasionally from Archangel, mixed by accident with yellow deals, are of excellent quality—the white deals from that country that come nearest to those of Norway in quality are those of Narva—they are brought of the width of 11 and 9 inches—when properly seasoned they can be used for all purposes to which Norway white deals are applied—next in quality to those of Narva are the white deals from Riga, which are brought both 9 and 11 inches wide. White deals are imported from St. Petersburgh, both 9 inches and 11 inches wide, in considerable quantities—they are not uniform in texture, but contain hard veins, and they have the defect, (however long they may have been kept,) of expanding and contracting with change of weather, so that if used in the panel of a floor, the wood alternately enters and recedes from the groove into which it fits, as the paint will show, when that kind of deal has been used for a panel.

Battens are deals 7 inches wide, and are principally used for floors. The best yellow battens are imported from Christiania; a large number of both white and yellow battens were formerly imported from Longsound in Norway, but battens of this description are now imported from Dram; they are from about 6½ to 6¾ wide. The white especially are of an excellent quality, and so are such of the yellow as are not sappy; the sappy ones preponderate in number, and on account of their cheapness are frequently used as a substitute for timber, in building the smaller description of houses. The next in quality to the battens of Christiania and Frederickstadt, are those which are imported from Archangel and Onega, though few have of late come from the latter port. Yellow Archangel battens cost usually somewhat more per Petersburg standard than the 11 inch planks. Both Archangel and Onega battens have the defect of having black bark round the knots, the wood of which is dead, whereas the knots of Christiania wood are bright, and firmly united to the substance of the tree. Yellow battens are imported also from Petersburg considerably inferior in the quality of the wood to those of Archangel and Onega.

American Deals are of three descriptions, viz, the yellow pine, the red pine, and the white spruce. A fourth, the hemlock-spruce deal is sometimes brought, but it is too bad in quality, and the quantity too small to deserve further notice.

Yellow Pine Deals.—The best of the yellow pine deals are shipped from the St. Lawrence, some are floated down the river from the mills to the port of shipment, and when taken on board are saturated with water, and covered with river silt, others are put on board craft, and come bright from the saw to this country. Of the bright deals, the very best quality are those from the Riviere de Loup. In a very good parcel of yellow pine deals about two-fifths will be perfectly clear of knots.

Yellow pine is of a very light and spongy texture, and the more completely it is of that texture and the opposite to what is hard, fibrous, and stringy, the better it is for all the purposes to which it is properly applicable, such as the panels and mouldings of doors and shutters, and other internal fittings of houses, the framing of cabinet-work, all those purposes in short for which lightness and no great strength is required. It preserves the form which the joiner gives it without warping, and this property, coupled with the facility of obtaining it free from knots, fits it admirably for the carver, the musical instrument maker, the maker of Venetian blinds, for patterns for iron castings and similar purposes, the inferior yellow pine deals being coarser in the texture of the wood and more knotty, are mostly used for ordinary packing cases. If the yellow pine is exposed to damp in any confined situation it rapidly decays, but in the open air, for palings raised from off the ground, weather-boarding to sheds, and wherever it is completely well ventilated, it lasts a long time, although exposed to alternations of wet and dry. Its spongy texture prevents it being rent so much as deals of a more rigid substance are liable to be, by exposure to the weather. It is now much used for the decks of ships, as it resists the effects of the sun better than the European deals.

Red Pine Deals come in very small quantities, so small indeed, that they are seldom separated from the yellow pine deals with which they come mixed; the best description are such as are brought from the Riviere de Loup. The red pine deals will answer for most of the purposes to which the yellow or Scotch fir deal of Europe is applied. When used for floors in houses, these deals have the defect of turning

of a very dark colour, but this probably is owing to the resinous texture of the wood, which causes dust to adhere to its surface, and might be prevented by washing the floor with alkaline ley, or any other solvent of resin.

White Spruce Deals.—Of the American white spruce deals, none, not even the very best, are to be compared for quality to the white deals of the north of Europe. They have two faults— they are very liable to warp, and the knots in them (owing to the bark adhering to the branch while the wood grows over it), are liable to fall out and leave a hole in the board. However long they may be kept they never lose their property of warping, and are consequently unfit for joiner's work. They are used only for the floors of the most ordinary houses. They are extremely liable, if placed in damp situations, to decay. An instance of this is mentioned by Mr Warburton, in his evidence upon the Select Committee on the Timber Duties, 1835, as having occurred in the floor of his counting house at Lambeth, which he had caused to be made of spruce deals as the cheapest material. An unusually high tide in the Thames overflowed it. It was covered at the time with oil-cloth, and the oil-cloth being replaced upon the floor before it was thoroughly dry, in less than a week the dry rot had spread over the whole floor, and had penetrated in some parts below the surface of the deals. Of this species, as well as of every other description of American deal, and most especially of yellow pine deals, it may be observed, that they ought only to be used in situations that are perfectly dry, or if not dry, that are completely exposed to the air. Spruce deals (particularly the prime planks 11 and 12 inches wide) that come from St John's and St. Andrew's in New Brunswick, are chiefly used for making packing cases.

It is stated that every deal of yellow pine that has been shipped in America in a wet state, when it arrives here, is covered over by a net-work of little white fibre, which is the dry rot in its incipient state. There is no cargo (even if it has been shipped in tolerably dry condition,) in which, upon its arrival here, some deals will not be found with the fungus beginning to vegetate on their surface. If they are deals that have been floated down the rivers in America, and shipped in a wet state only, they arrive quite covered with this net-work of fungus, so that force is necessary to separate one deal from another, so strongly does the fungus occasion them to adhere, they will grow together again, as it were, after quitting the ship while lying in the barges before being landed. Accordingly if a cargo has arrived in a wet condition, or late in the year, or if the rain falls on the deals before they are landed, and they are piled flat, one on the other, after the usual manner of piling deals, in six months time or even less, the whole pile of deals will become deeply affected by the dry rot, so that wherever the flat surface of one deal lies upon the flat surface of another deal the rot penetrates to the depth perhaps of one-eighth of an inch. Its progress is arrested frequently by re-piling the deals during the dry weather of the month of March, and by sweeping the surface of each deal before it is re-piled with a hard broom: but, perhaps the best way is to pile the deals in the first instance upon their edges, by which means the air circulates round them, the growth of the fungus is checked, and the necessity of re-piling them prevented.

As respects the dry rot, it may be noticed, that there are but very few cargoes of timber in the log that come from America, in which, in one part or other of every log, a beginning of the vegetation of the dry rot is not apparent. Sometimes it will show itself only by a few reddish discoloured spots on the surface of the log, which, if scratched with the nail, it will be seen that to the extent of each spot the texture of the timber to some little depth is destroyed— it will be reduced to powder: a white fibre will generally be seen growing on these spots. If the timber has been shipped in dry condition, and the voyage has been a short one, there may be some logs without a spot, but if the cargo has been shipped in a wet condition and the voyage has been a long one, then a white fibre will be seen growing over every part of the surface of every log. It should further be noticed in connexion with this subject, that there are two descriptions of European timber likewise very liable to take the dry rot, yellow Petersburg deals and yellow and white battens from Dram in Norway. Battens that have been received from Dram and allowed to be a long time in bond in this country, without being re-piled in time, (as they ought to have been,) have been as much effected by the dry rot as many American deals, though this has not happened in as short a time as has been known to be sufficient to rot American deals. That the fungus growing on the surface of American timber is the dry rot appears to be quite certain: it has all its character, as to appearance and as to effect, for whenever it spreads over the surface, the deal, if neglected, is reduced to the state of powder.

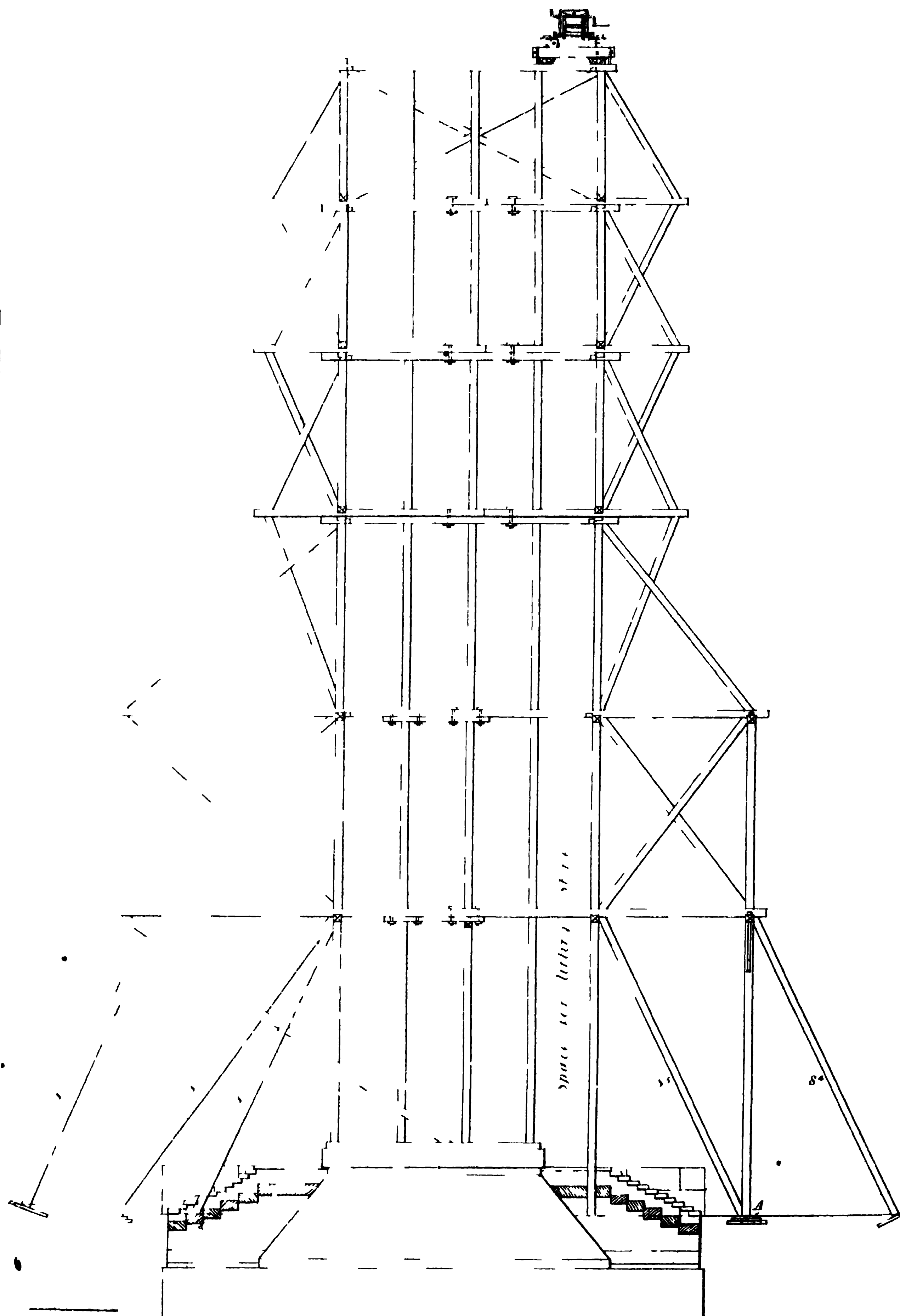
These are a few leading facts connected with the important subject of the selection of such timber as is placed within our reach, and to which for the most part our choice is limited. For a mass of information on everything connected with the subject we may refer to the documents from which these few particulars have been chiefly gathered, the Evidence given before the Parliamentary Committees on the Timber Duties.

RAILWAYS IN INDIA.

In a preceding article we have spoken of the political and mercantile advantages derivable from the further extension of steam navigation in British India: we will now follow up the subject with a few further remarks on the still more important subject of *railways*. India is confessedly an agricultural country, its internal sources of agricultural wealth, and its capabilities of production are literally boundless, sufficient to supply more than thrice its present population of 150 millions of inhabitants, with all the necessaries and luxuries of life, and, so far as regards its exports, to satisfy the wants of Great Britain, rendering her independent of foreigners for her supply of cotton, tobacco, sugar, and tea. Lords of the soil, the East India Company depend chiefly upon agriculture for their immense annual revenue, and consequently for the maintenance of their power: it is to this certain source the merchant looks for his wealth, the many millions for their support, and the manufacturers of this country for the means whereby they are enabled to maintain tens of thousands at home, and to supply every quarter of the globe with the fruits of their industry: nay, the very existence of the Honourable Company depends, at the present moment, much more upon an immediate development of its internal resources, than upon continuing their career of conquest and acquisition of territory now so happily begun. It is not sufficient that they encourage private or public speculation, that they incur a large annual outlay in promoting agricultural objects, and use their endeavours to introduce better modes of culture and manufacture of the chief staple commodities: other, and more extensive measures must be immediately entered upon, in order to meet the wants and expectations of the age in which we live: the country must be thrown open to class colonization, to men of spirit and possessing some small capital, and its agriculture must be promoted by the means of railways in those central provinces which are deficient of navigable rivers.

Upon looking over the map of India it will be observed that many of the finest and most productive provinces are isolated, possessing neither good roads nor navigable streams; the rich products of Malwah, the southern parts of Allahabad, Gundwana, and Hyderabad, have to be conveyed to the respective markets on the backs of oxen, thus the cottons of these insulated provinces, after being collected and rudely cleansed, are transported to the banks of the Ganges in this manner, over, in some places, almost impassible roads, the journey being performed in not less than 20 or 30 days, during which time, the loosely packed bales are exposed to a burning tropical sun as well as to the dews of the night, and other mischances attending long and dangerous journeys: who then, after considering the rude manner in which this commodity is cultivated and cleansed, can wonder at its being inferior to the produce of the West? the only surprize is, that after this rude journey, and its equally rude modes of conveyance down the Ganges to Calcutta, it should be worth any thing at all.

The valley of the Ganges extending over a surface of 400,000



View from A to B East & West sides.

square miles, is so intersected with natural canals, as to render the adoption of railroads below Calcutta impossible, and many of the fertile valleys of India, from being annually inundated, will be found insuperable difficulties to their adoption in these particular parts but, the vast plains of upper India, of the Deccan, and the Peninsular, present an inexhaustible field for the skill of the engineer, the architect, and the surveyor, in forming railroads From Calcutta to Benares, now a distance of 4 1 miles, a considerable time might be saved by a railroad passing through the coal district of Burdwan, Mongore, and the rich province of Bahar; or a still nobler road might be formed from thence through Berhampoor, Bhaugulpore, Dinapoor, Ghazipoor, Benares, Allahabad, Etawa, Kajghant Agra, Muttra, Delhia, to Kernaul, a distance of 1208 miles Again, let railroads radiate from the tributary state of Nagpoor to Benares through Jubbulpore, Rewar and Mow Gunge, meeting the railway half way from Calcutta to Benares From Nagpoor to Hyderabad, a distance of 31 miles over a very fair road, from Benares to Lucknow, Bareilly, Mouradabad and Hurdwar, a branch from Agra might be formed passing through twelve considerable places of trade to Gwalior, the capital of the Mahratta chief a place of great note as a commercial and military depot From Nagpoor to Saugor via Taru Ghat to Chunda via Hingun Ghat. Nagpoor from its central position, its vast fertile plains adapted for the most extensive cultivation of cotton, &c, its proximity to other fertile provinces, and its position as a British military station, is invaluable as a central point of railway communication From thence to Benares on the one side, and Hyderabad on the other, there are few natural impediments, none but what might be readily overcome by the skill of English engineers. Again, from Calcutta to Hyderabad via Masulipatam, the distance is only 22 miles by the present route, and there is little doubt, but that a railroad could be formed on this route, approaching to within a very easy distance from Calcutta from Hyderabad to the Poovrah Ghats, the road is gently undulating, passing occasionally over narrow valleys rank in vegetation, which would require to be crossed by viaducts the chief river is the Kistnah, a deep rapid stream, but having a firm soil beneath the deep vegetable earth covering its banks, capable of supporting the viaduct or bridge From the Madras to the Hyderabad via Cuddapah, Nundiaul, Pingtorr and Punganul is a distance of 405 miles by the present route, the natural difficulties are far greater than other routes previously noticed, there being four great rivers to cross from the second barrier pass to Hyderabad There is another route to Hyderabad via Nellore and Ongole.

Other routes from the central provinces to the presidencies, and from Calcutta to the Upper Provinces, might be pointed out as applicable to railway communication, but those we have already enumerated are sufficient to show the importance of railway communication in a country so densely populated, and so extensive It may be said that the Indian government has no power to cause railroads to be constructed in the tributary states of Hyderabad and Nagpoor, but in answer to this we must observe, that where they must derive such benefits, no reasonable objections can be made on their parts that common roads have already been formed under the direction and control of the Bengal, Madras, and Bombay governments, and that the expences of constructing them are so insignificant as not to be worthy notice, in fact, are not to be compared to the cost of railroads in America. The land through which they pass costs nothing, labour may be had for 3s. or 4s. per month for each labourer, the Deccan, and in fact all India abounds with several kinds of acacia and other woods almost equalling iron in hardness and exceeding it in durability. The destructive attacks of the white ant on these wooden rails may be readily guarded against by the use of creosote or mineral solutions, which will not only effectually remedy this evil, but preserve them from the effects of dry rot.

It is true that the skill of the engineer practically acquainted with the formation of railways in this country, is wanting for these projected improvements, but many able engineers may be obtained in this country, several also in the honourable company's service have greatly distinguished themselves in forming common roads, building bridges and other works of improvement, and schools for this department of engineering might be very advantageously established in the three presidencies, being placed under the control of practical engineers sent out from this country

The only railway ever attempted in India, was that from Saugor to Calcutta, a distance of 0 miles through a swampy country periodically overflowed by the waters it was an unfortunate project set on foot by a few individuals, inexperienced in knowledge of that portion of the country, and its failure, which was foreseen by every person of common sense, had the ill effect of discouraging future plans of the like nature based on better principles We can hardly expect that iron rails can be adopted until such time as foundries are established in that country for manufacturing the native material, nor is iron at all necessary so long as India contains wood equally durable. For the protection and constant repair of these railways, it would be politic to have walled villages built every seven or ten miles the tenure of occupation of land to a certain extent being held by the inhabitants to watching and keeping them in repair Where the land is very soft and yielding, the rails should run upon piles driven deep within the earth and resting upon the firm strata beneath

We trust that the East India directors will take this matter into their most serious consideration, the example, set by them would soon be followed by the union of private individuals, both native and European, as well as by the capitalists of this country, who at present find much difficulty in employing their capital to advantage. A slight glance at the amount of import and exports of India, at its internal trade, and boundless resources, must convince every one that railroads so cheaply constructed, and kept in order, must eventually prove exceedingly profitable.

THE NELSON MONUMENT

(With an Engraving, a Double Plate, XVI.)

Architect, William Railton, Esq

We feel much pleasure in being able to present our readers with some particulars as to the construction of this column, particularly with regard to the scaffolding, which is at once ingenious, effective, and of great strength, and at the same time of great simplicity, if our readers will turn to the first volume of the *Journal*, page 267, they will there see the drawing of the scaffolding adopted by Sir Christopher Wren, in the erection of the Monument of London they will observe the immense quantity of poles used, and the mode in which they are put together with some hundreds of cords, so that this fragile scaffold is greatly dependent upon the tenacity of the cords, if one were to break while raising a heavy weight the whole would be in jeopardy of falling down

In the scaffold before us there is no hazard of this kind, all the upright posts and horizontal beams are constructed of whole timbers, varying from 11 to 15 inches square the posts are mortised at the top into the beams, and the latter are halved on each other at the angles, the struts S, springing from the ground up to the level of the first stage are also of whole timbers, about 11 to 12 inches square; the braces or struts of each upper story are of half timbers bolted together in the centre, and abut at the top with a mortice and double shoulder onto the posts.

The total height of the scaffolding above the level of Trafalgar Square is 150 feet by 90 feet square on the ground line, and contains 1 0 loads of timber. As each story of scaffolding is erected, the machine called the "traveller," a moveable crane or crab engine, is placed on the horizontal beams, and travels in the direction from A to B, on rails with a cogged rack, on the side laid on the top of the beams, and it also has a transverse motion on cross beams resting on a carriage, which travels upon the rails A to B, these cross beams also have rails with a cogged rail on the side, to allow the traveller to run in the direction from C to D. It is moved either way by gearing,

consisting of a cog wheel, working into the cogged rail, attached to the machine by the aid of one man standing upon each stage. This travelling crane or crab, which has received some important improvements from Messrs. Grissell and Peto, is the most important machine a builder can have for erecting buildings where there is masonry, by it the stones are lifted off the truck, raised, and lowered immediately on to their beds, and adjusted with the aid of a mason and his labourer only, besides the two labourers with the machine, by which means great economy in labour is obtained. As soon as the erection is brought up to the level of the first stage, the next story of scaffolding is erected, and then the "traveller" is removed up to the top, and so on until the whole construction is finished.

This description of scaffolding was first introduced into use by Grissell and Peto in the erection of the Reform Club House in Pall Mall some three years since, and was found to possess so many advantages over the ordinary scaffolding made with poles, that it is not only used by them at the New Houses of Parliament and in all their other heavy contracts where masonry is chiefly concerned, but is coming into general use by other large builders, as at the Royal Exchange, Sun Fire Office, and the new Club House in St James's Street. Its stability has recently been tested beyond all doubt at the Nelson Column, both as to its resistance to wind at a great altitude, and in its strength and steadiness while hoisting heavy weights. One of the parts of the statue of Nelson weighed 12 tons, and the load, although eight hours upon the scaffolding, did not occasion the most trifling vibration to be observable.

One of the advantages of this mode of scaffolding is, that the timber is all convertible for the building at which it may be used, as the scaffolding may be dispensed with as soon as the carcase is covered in, and it is generally used up in the internal carpentry of the building, the enormous waste in scaffold cords is also avoided as well as the considerable expense of a number of masons' labourers, who are always necessarily in attendance upon a scaffolding of the ordinary kind during its use.

Before we close this description of the scaffold, we must not forget Mr. Allen, the indefatigable foreman of the masons of Messrs Grissell and Peto, under whose able directions the scaffolding of the Nelson Memorial was erected.

The foundation of the column consists of a bed of concrete resting upon a bed of gravel, upon the concrete is carried up brickwork of hard stocks set in cement, the column is solid and constructed of granite from Dartmoor, each course consists of seven blocks, one in the centre forming an oblong square, the others have the joints radiating from the angles and middle of the centre block, and each block is dowelled together vertically with slate dowels. The bell of the capital is also of granite, to which are fastened the enrichments and volutes, which are of bronze, executed by Mr. Clark of Birmingham. The cippus or pedestal upon which the figure stands is likewise of granite. The figure is sculptured by Mr Baily, the eminent sculptor, it is of Craigleith stone from the Liver rock quarry at Granton in Scotland, belonging to the Duke of Buccleuch, it is of a dark brownish tint and very hard it is in three parts, the lower block forming the plinth, the bottom part of the figure and the capstan at the back, which is represented with a rope coiled round it, is said to weigh 12 tons, and originally when the block was removed from the quarry it weighed 30 tons, and formed part of a block 15 tons weight in the quarry, (see *Journal*, Vol. V, 1842, p. 230 and p. 284.) The figure is fixed to the pedestal by a dowel of York stone 1 foot 6 inches long and 10 inches square, half let into the top of the pedestal and the other half into the plinth of the figure. The other parts of the figure are connected with similar dowels. The figure, we understand, has been coated with oil and wax, which gives it its present dark appearance but it will ultimately get lighter.

The following particulars show the time occupied in raising the lower block of the figure, it was adjusted on the ground on the 3rd of November, at 5 h. 20 m. a.m.—it reached the first stage at 6 h. 45 m., second stage 8 h. 5 m., third stage 9 h. 25 m., fourth stage 10 h. 23 m., top 11 h. 20 m., total time six hours, it was removed horizontally from the end of the scaffolding to the centre in two minutes, and completely set in its place at 11 h. 45 m.

The landings and the steps surrounding the base are laid upon brick arches, and the plinths at the angles are to be surmounted with lions couchant, and the panels of the pedestal to be filled in with bronze bas-reliefs representing the heroic deeds of Nelson. In our 2nd volume, p. 279, will be found an engraving of the original design.

In conclusion, we cannot speak too highly of the manner in which the works are executed. They do the greatest credit to the establishment and enterprise of Messrs. Grissell and Peto.

Annexed we have given a table showing the measurements of the details.

Details of Column	ft	in	height ft.	in
Figure of Nelson	17	6		
Plinth of ditto	1	3		
			18	6
Cippus, or Pedestal upon which the figure stands 7 ft 6 in diameter,				
Base of ditto, 8 ft 8 in diameter				
			7	6
Column				
Abacus of capital	2	6		
Bell of capital in 4 courses, 16 ft across the volutes	10	0		
Top course of column with annulus, 9 ft diameter top of shaft	3	2		
10 courses below 2 ft 7 in each	25	10		
9 ditto 2 ft 11 in	26	3		
8 ditto 3 ft 4 in	26	8		
Lower course (10 ft 6 in diam) including the upper torus of base	3	6		
Scotia and lower torus of base	2	7		
Plinth of base, 14 ft square	1	10		
Height of shaft, base, and capital	——		102	4
Pedestal				
Scotia above	3			
Moulded cornice and dentill	2			
Bed moulding and upper course	2			
6 courses, 16 ft square, 2 ft. 4 in each	11			
Lower course and part of moulding	2			
Moulded base	2	2		
Plinth under ditto 22 ft square	2	8		
Height of Pedestal	——		29	8
Top step below pedestal, 27 ft 6 ft square	3	0		
Lower ditto 33 ft	3	0		
Height of two steps	——		6	0
Solid brickwork in cement to foundation of column, 52 ft square at base, 1 ft 6 in high, then gradually diminishing all round, 12 ft 6 in high to 33 ft square, then 1 ft 6 in. high; total height of brickwork			15	
Concrete 80 ft 6 in square			8	
Total height, including foundation,			187	6

The foundation rests upon a firm bed of gravel 12 feet below the foot paving of Charing Cross, or 16 feet 6 inches below the level of Trafalgar Square.

Surrounding the base of the column there is to be a landing 10 feet 6 inches wide, and 10 steps 80 feet square at the bottom, in all 7 feet high above the level of the paving in Trafalgar Square, making the total height of the column above this level 152 feet 6 inches, and including the figure 171 feet.

The height of Pompey's Pillar is 90 ft.; Trajan's Pillar, 115 ft.; The Monument of London, 202 ft.; The York Column, 138 ft.; The Nelson Monument at Dublin, 134 ft., and at Yarmouth, 140 ft.; Napoleon Column at Paris, 132 ft., July Column, 157 ft., and the Alexander Column at St. Petersburgh, 175 ft. 6 in.

CANDIDUS'S NOTE-BOOK.

FASCICULUS LIV.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. Why anonymous criticism should be a whit more odious or more indefensible upon architectural topics than any other, it is difficult to understand; yet so it seems to be considered by some folks—who would probably be for abolishing criticism altogether, being conscious of having very little favour to expect from it. Admitting the system of anonymousness to be ever so reprehensible—what then? It was not architectural writers that brought it up, they found it already established, and that so far from being considered disgraceful, it was one which our most eminent writers had supported by their talents. Anonymous criticism may be stupid, but then censure its stupidity, not its anonymousness. At any rate it does not attempt to bias the reader's judgment by the *prestige* of a name, and so far its stupidity is honest and is harmless.

After all, too, is anonymous criticism invariably so dreadful as some would have us believe? Has Barry had any cause to complain of its severity or its unfairness? or has it never done justice to the productions of others in the profession? Aye! but then, it will be said, that it is because it pays deference to names, and takes its *cue* from popular opinion. Does it? Egad! John Nash and Robert Smirke would tell quite a different tale, they would say that it pays no respect to names—at least not to theirs, which it has treated very unceremoniously. We must have either anonymous or milk-and-water criticism, unless we choose to resort to the only other alternative, of having none at all—the last, no doubt, a consummation devoutly to be wished for, in the opinion of those excellent people whom criticism never praises, and never instructs or warns.

II. We are congratulating ourselves upon having reached a new epoch in art, at having entered upon the Victorian era of it, when it is to blaze with a lustre yet unknown. Fudge! What if a "morning star," as Pugin calls it, be rising at Westminster, all is Cimmerian darkness at Bloomsbury, where Smirke in night or knight-hood is suffered to reign supreme. Most certainly all the proceedings connected with the Museum buildings have, up to the present moment, been kept shrouded in impenetrable mist, mistiness, and mystery. Not even a single one of the enlightened and vigilant guardians of art, or of those who compose Fine Art Commissions, has thought fit to bestir himself on the occasion, and drag the matter formally before the public, in spite of Peel and his prophecy. It might be thought that Peel has had a sufficient dose of Smirke at Drayton Manor, or if he is really satisfied with that as a specimen of architectural genius, his opinion in matters of architecture ought to pass for nothing. Nevertheless, all seem to stand in awe of the prime minister and his pet, and, strange to say, even the great John Britton himself, who has always caught at every opportunity of thrusting himself before the public *in propria persona*, has not come forward with an "*Address*" to any one, individual or body, on the subject of the British Museum!

III. It is impossible for any one to say of Sir Robert Smirke, that he is a temporizing or time-serving man, since, instead of at all bending to the spirit of the present times, or complying with its humour, he stands out resolutely against it, and shows himself a staunch conservative in maintaining that system of monopoly and irresponsibility under which he has *flourished*. The public is to him just the same ignoramus, insignificant public as it was some thirty years ago, whether it brays forth its approbation or its censure is to him matter of utter indifference. Very likely, therefore, he smiles with contempt at those—and some there are—who would fain coax him into showing some kind of deference to public opinion. Most sulkily serene, Sir Robert pays no attention either to such cajolery or to reproach. Why should he now be called upon, for the first time, to satisfy beforehand the prying curiosity of an impertinently inquisitive public, after having erected so many public edifices without being subjected to any such ordeal or *surveillance*? Reasons, however, there may be, although they are not obvious to himself, and one of them is, because such matters have begun to be put upon a somewhat different and more liberal footing than formerly, nor has the confidence reposed in the public hitherto thwarted schemes of improvement, for the public has generally urged them forward and encouraged them. Another reason wherefore the architect of the British Museum should be called to give some pledge that that edifice will, when completed, be both satisfactory and creditable to the country, is that no such assurance is afforded by any or all of the buildings he has hitherto executed; since, so far from serving as testimonials of superior talent, they rather amount to a positive DISQUALIFICATION on an occasion like the present, one of unusual importance, and all the more important because no similar one can occur. It is true other museums may be founded in different parts of the country, and some of them may be, if less extensive, nobler works of architecture, yet they will not be *The British* Museum, and however gratifying it may be in itself to behold such structures, it must at the same time be not a little mortifying to find that the metropolitan and national one is quite eclipsed by them in architectural style and design. There are some who might still avert the mischief, but they evidently do not care to interfere, fearful, perhaps, of giving umbrage to another Sir Robert who stands as sponsor to Smirke's museum. What are the royal and noble patrons of art about, that not one of them can spare a moment to bestow a thought on the unfortunate edifice in Bloomsbury? Is there not one of them all to come to the rescue, and to avert from that structure the sad inglorious fate of being doubly *Bobbyfied*.

IV. And what says that very respectable old gentlewoman, Dame Sylvanus Urban, on this occasion? What is the old lady's opinion as to the goings-on at the British Museum? Ah! Dame Urban is a cautious body, and she therefore does not care to risk giving umbrage to any powers that be; so that, if her opinion be worth having, we may guess, from her very discreet silence, of what kind it would be; for could she squeeze it out of her conscience to take the part of Smirke's handywork in Bloomsbury, what a cackling about it there would be! However, if intolerable as a specimen of any other, the British Museum will, no doubt, prove a very respectable sample of the *Mill-and-water* style, yet as such superfluous, as we have quite samples enow of that already.

V. Even royal taste is sometimes grievously at fault, and what is more, is grievously found fault with. Thus was it with the Albert military hat, which the gentlemen of the army protested against as a vile deformity. And if princes can err in matters of taste, *a fortiori*, so also may prime ministers, consequently Sir Robert Peel's recommendation of another Sir Robert's design, according to him the very *ne plus ultra* of architecture, ought to stand for nothing. Sir Robert Peel may be a very good *cabinet*-maker, Sir Robert Smirke an excellent warehouse-builder, but let them stick to those trades, and not foist upon the country such a dowdy design as the one concocted for the British Museum out of the Post Office and the Custom House. Any Pecksniff would have produced something as good, and just as "*respectable*,"—for some, it seems, have expressed themselves ready to be satisfied if what ought to be rendered a magnificent national work, can be patched up into something "respectable," in other words, be made a *tidyish sort of a job*—so much for the March of Art in England!

VI. One of the most extraordinary excuses ever put forth on any occasion, is that which has been assigned on the part of Sir Jeffry Wyatville, for the entire omission of any plates of the interior in his 'Illustrations of Windsor Castle,' for the reason that that part of the fabric may undergo considerable alteration in the course of time. a very strong reason, one would imagine, for such illustrations being given, not merely as present studies, but as faithful records of his own work, should it at any future period be destroyed, whether by being changed into something else, or by being burnt down. Would the illustrations he has given us, lose at all in interest or value, were a conflagration to sweep away the whole of the pile? How many buildings there are, in respect to which nothing, or comparatively nothing, can now be learnt, because authentic and sufficient memorials, taken at

the time, or when they were in a perfect state, have not been perpetuated by the graver* All that we now know of James Wyatt's *chef d'œuvre*, rest merely upon tradition and conjecture, perplexed rather than aided by paltry views, which leave us quite at a loss as to the superlative beauty and magnificence claimed for the structure in terms of eulogium that read like newspaper puffs.

VII. Now that symbolism is come into vogue, it is odd that no one has yet protested against the monstrous paganism and heathenism of the Nelson column or any other of the kind, as being evidently derived from monuments of Phallic worship, consequently not unmeaning, but on the contrary, pregnant with a meaning that will not bear to be explained. It is true symbolism does not scandalize in such cases, because no one sees or understands it, and, for a similar reason, other symbolism may be equally unavailing.

VIII. It does seem strange, that with a frontage of not much less than 150 feet, the architect of the new Conservative Club House, should not have placed the entrance in the centre of his façade, or if circumstances absolutely compelled him to place it at one end, it should not have been within a recess. There is, indeed, something corresponding at the other extremity of the front, yet not sufficiently so as to preserve symmetry, and even were such the case, gaps of this kind at the angles of the ground floor, where the expression of strength and solidity is most of all desirable, would be a defect detracting very much from whatever other merits and good points there may be in the design. Perhaps the architect was determined that it should be impossible for any one to say that he had copied—or, indeed, looked at Barry, so resolved, *coute qui coute*, to give us a specimen of something altogether different, and therein he has certainly succeeded.

IX. A good deal of sentiment and pathos has lately been expended upon the quondam College of Physicians in Warwick Lane, and that venerable piece of rubbish yclept Old London Wall. Yet it might be better, if instead of all this Parthian retrospectiveness, these long and lingering glances backwards at antiquity—a lady called by the poets "hoar antiquity"—it might be better and somewhat more to the purpose to pay greater attention to the future, to look forwards a little more than we do, and bethink us what sort of figure we ourselves shall cut in the eyes of posterity. While people are moralising, poeticising, fantasticising, on some sturdy remnants of old brick and mortar somewhere in the ultima Thule of the metropolis, they have no eyes at all for the portentous operations now going on in Great Russell Street. At any rate they have no voice that exclaims against such doings, and their eyes they employ merely to wink at them. It might be supposed that the Museum was a mere parish job, which concerned the good folks of Bloomsbury, or the "Bloomsbury barbarians," as Hook used to call them, alone and with which no one else has any right to meddle or make. Infinitely better would it have been to have kicked out Sir Robert at once, and plastered him with a good round pension, which last would, no doubt, have convinced him that if he abandoned the field to another, he had made a masterly retreat for himself, and could enjoy, if not *otium cum dignitate*, his *otium cum pecunia*—a far better thing still. How he came to be appointed architect at all to the Museum, puzzles many, and pity it is that the appointment was not made a complete sinecure to him, some understrapper, some "*Pinch*" being employed, as the great man's proxy. As matters have been managed, Sir Robert will not be able to find any convenient *sub* or proxy, who will bear for him the disgrace he is now bringing upon himself. It is true the building is not yet done, yet it is now completely "done for."

X. Think heaven! though literature is now for the most part reduced to a mere manufacture, art is not yet workable by machinery, although some of those who call themselves artists are in themselves no better than machines, with about just the same intelligence of and affection for it as the implements they handle. They have one or two patterns, which, either through laziness or incapacity, they apply pretty much in the same way on all occasions, no matter under how widely different circumstances. No wonder, therefore, that at the very best no more than mere decent mediocrity and insipid, flavourless common place are the result. How should that possibly be expressed which is not felt? How should there be aught of genuine and genial feeling where every thing and every part is concocted out of second-hand and borrowed ideas, and those perhaps very ill understood? I have met with architects who might have been very clever as masons, but who have had no more notion of art or of the poetry of art than an Irish labourer, although able to talk more glibly about Vitruvius and Palladio. Well! those are just the sort of people to admire the British Museum—perhaps, to build one.

XI. It is cleverly remarked by a German architectural critic, that it is generally considered quite enough to provide sufficient light in a building, no matter whether there be any *effect of light* or not. Artist-like study and treatment in that respect are, indeed, hardly to be looked for in ordinary houses or in mere sitting-rooms; but neither on we find anything of the kind in superior ones, except on very extraordinary occasions, and partly arising out of mere accident. One may go over a large mansion containing numerous and most sumptuously furnished apartments, without being struck with a single effect of the kind in any part of it, or any thing whatever that amounts to character and effect purely architectural. One sees what the maximum of cost and the minimum of imagination if not exactly of taste, can accomplish, and even if there be nothing calling for particular censure, there is nothing to enchant by novelty of effect, or by decided individuality of character. As for any peculiarity of arrangement, that might as well be looked for in the London stereotype front and back drawing-room, or in a row of ready-made speculation houses. A good deal has been said lately about "architecture for the poor!" but it would be hardly less charity to think of architecture for the rich—for those who are obliged to conceal the utter architectural nakedness of their mansions by the mere trappings supplied by the upholsterer, displaying most ostentatiously the costly poverty of their taste, and the paucity of their ideas. Exceptions there are—though not in our royal palaces—and I lately beheld one in an apartment which, though not very large, and rather sober in regard to decoration than otherwise was most striking for its high degree of architectural beauty, and the very peculiar kind of it, arising both from unusualness of plan, and from the mode of lighting, and the charming effects attending the latter. So replete, indeed, was it with beauty of such kind, as to possess a variety which nothing can stale. From almost every point a new picture—a fresh combination as to perspective, is presented. It should be observed, however, that this is an entirely *con amore* work,* planned by the proprietor himself. It may be wrong for amateurs to turn architects, one consolation is, there is very little danger of architects turning amateurs, and giving more study to an episode in a plan than they now do to a whole building, though it be one as big as the British Museum—whose merits are all summed up in that little word.

SOME OBSERVATIONS ON THE ANCIENT ARCHITECTURE OF THE EGYPTIANS.

In the very earliest ages of the world, man must have directed his attention to the art of building, as habitations were indispensable, not only for comfort, but also for protection, the necessity for some defence against the parching heat of the sun, the power of the elements, the ferocious attacks of wild beasts, and the treacherous assaults of fellow man must have been early experienced, and the rational faculties with which the Deity had gifted him, must at once have been called into action to accomplish this desirable object. These buildings, on account of the roving lives which their occupants led, were constructed of very slight materials, and must naturally soon have fallen a prey to the destructive hand of time. To expect, then, after a lapse of some thousands of years, to find any remains of those primæval buildings would be most absurd, but from observing the practices of men, now in an uncivilized and primitive state, as well as the authority of the earliest records, we have very strong presumptive evidence of what must have been the first dawning of architectural science.

It is recorded by the author of the Pentateuch, that Cain built a city, and called it Enoch, after his son. This town, being a collection of huts, probably constructed in the manner of those now to be seen

among the savage Indian tribes, fell to decay, and no vestige of those buildings now remain, to mark their former existence. The progress of building must have been rapid, [and the art of carpentry well understood, to have enabled Noah to construct the Ark, which, with its heavy freight, was for many days exposed to the tossing of the billows, and the rage of the elements. The subsequent design of the Tower of Babel, and the extent to which the proposed work was carried into execution, must convince us, that even at that early period, architectural knowledge had greatly advanced.

Satisfactory, however, as may appear those records which mark the progress of intellectual refinement in the early ages of the world, still historical evidence alone can be of little practical utility to the modern architect; to the examples of the most ancient existing ruins, must he recur, to trace the features of the science in by-gone days and in this investigation, three countries present their claims for the palm of originality, Egypt, Hindostan, and Persia, where architectural remains of great magnificence are now to be seen, gracing their almost tenantless plains, the admiration and astonishment of the most enlightened travellers and antiquarians.

As to which of these three countries we are indebted for the first degree of perfection in the architectural science, there are very numerous and conflicting opinions, and seemingly strong evidence has been produced on each side. A strong argument in favour of the Egyptian style is the very great simplicity of design observable in all their edifices. Although the leading features of the ruins in the three countries are similar, yet it is easy to perceive, from the drawings which we have of some of them, that the simplicity of the Egyptian has in some measure been departed from in the Hindostan edifices, and that the introduction of circular outlines bespeaks a certain degree of perfection in the art of designing, unknown to the architects of Egypt, and the delicate pillars and refined ornaments of the Persian architecture prove a still further progress in that science, which must have originated in simplicity. The simplicity of style, in the absence both of tradition and historical records is evidence, the validity of which cannot be contended in favour of Egypt having been the nursery of scientific architecture, and to her the kingdoms of the East are indebted for those edifices "of other days."

In examining the progress of architecture in this country, we are altogether left to draw our conclusions from conjecture for in vain is the page of ancient history scrutinized, in vain are the present occupiers of this mysterious land consulted about those remains of the by-gone glory and forgotten wisdom of their forefathers. No clue to solve the hidden mysteries of those sacred temples, no recording monument to satisfy inquiring posterity, ages have gone by, time has rolled on, many generations have been called to their final account, still those massive ruins mock the power of time, pointing out a locality, where, in centuries long since passed away, science and art had their votaries, and the torch of wisdom burned brightly in those very regions, where in latter times, ignorance and gross darkness have sprung up.

Little reflection is required to convince us that those stupendous works of Egypt are not the production of men, to whom the first principles of science alone were known, or that those almost super-human structures could be the results of merely infancy in the arts. The progress of architecture must have made rapid strides, and some centuries of practice must have passed away, before such perfection could have been attained. It cannot possibly be supposed that men, whose greatest knowledge of building consisted in the erection of huts, could at once design edifices of such enormous dimensions and great solidity, calculated to withstand the ravages of time, and the erection of which must have occupied many years; or that an ignorant people could have devised the means of quarrying and dressing those large masses of stone, or placed them in their present positions, which even now, with our advanced knowledge of mechanics, and great improvements in machinery, we should consider almost impracticable. To a very mature age of architectural knowledge must those ruins be attributed.

The discovery, which it is stated Mons. Denon made at Thebes, of a stone covered over with hieroglyphics, and which, from its appearance, was evidently the ruined part of some more ancient temple, forming a foundation stone to one of those now standing, has been fairly adduced, as a proof of Thebes having been, at some much earlier period, adorned with temples and other public buildings, which must have either fallen to decay, previous to the erection of the present ruins, or been taken down to build those more ornamental edifices.

In that mysterious region, where now, surrounded by the scattered ruins of pyramids, temples and cities, the savage shepherd tends his roving flocks, once studied the author of the Pentateuch, and freely imbibed the wisdom of ancient Egypt. In that same district, where those remains of antiquity attest the departed refinement of the Egyptians, in other days Plato instructed his auditory, and Euclid wrote. Amid these ruins, the remains of three different forms of structure are to be observed, the pyramid, the temple, and the tomb or cavern.

To which of these the date of priority in construction is to be assigned, is a very difficult question to decide. Arguing from analogy, it would be reasonable to suppose that nature first pointed out to uncivilized man, the cavern, as the best form of habitation, but the superior workmanship observable in the interior of those excavations must at once dissipate this idea, and the refined and well executed sculpture on the natural rocky walls must be attributed to an advanced era in the art. The simple form of the pyramid, as not requiring great talent in designing, may be adduced as a proof of the priority of this structure; but the fact of these buildings being found only near Memphis, the city which historical records assert was built long after Thebes, must cast a great doubt upon the validity of this claim. The complicated form and skill required in both designing and executing the temples, presents a strong barrier to the supposition of priority of construction in these buildings. The absence of historical evidence on this point, leaves this subject altogether a matter of conjecture.

Those stupendous erections, the pyramids, which have withstood the destruction of time, for more than three thousand years, in external appearance may be said to be deficient in architectural character, and no beauty in design can be attributed to them; still, from their enormous dimensions, their colossal appearance, the massive materials used in their construction, and from the well executed workmanship, they must attract our admiration, and be justly numbered among the wonders of art. The description which Herodotus has given of the mode of construction of the pyramid said to have been built by King Cheops, must naturally lead the reader to view with astonishment, that stupendous erection and the circumstances which he mentions, of the building of this pyramid having occupied 100,000 men for 20 years, may be well adduced, as proof of the devotedness of the ancient Egyptians, to works of art.

The building which possesses most architectural character, and may be said to be the very basis of ancient architecture, considered in a scientific point of view, is the Egyptian temple, and though on first observing the peculiarity of the style, we may be led to form, perhaps, an unfavourable opinion as to its merits, still when it is kept in recollection that those people had no models to copy, or no design to borrow from other nations, but depended altogether upon their own resources, and followed nature as their guide, we must banish all unfavourable reflections, and award the well merited laurel to the authors of the science The characteristic features of these temples are the colossal form, the enormous size of the blocks of stone employed in the execution of the works, the tapering walls of a pyramidical form, the pillars of vast dimensions, and the arrangement and disposition of the several parts of the building.

In the columns, the change of outline seems to have been considerable. The simplest form appears to be a representation of a bundle of reeds, bound together near the top, with a cord wound round them several times, having a square flat stone laid on their top they are made to bulge out a little below the binding, in order to imitate the effect which would be naturally produced in a bundle of reeds, subjected to a pressure in a vertical direction.

In the Egyptian pillars, massive and heavy as they may appear, can be traced many of the features of those refined Grecian columns, which by all writers have been justly eulogised, and to which, too frequently, and very unjustly, the claim of originality of design has been yielded. The very striking analogy which exists between the examples of the two countries, must be very apparent, upon examination.

In the plain and simple pillars of the little temple at Luxor, resembling in form the trunk of a tree, we may behold the origin of the heavy and tapering Doric shaft. Other columns, representing a bundle of reeds, placed in a vertical position, and bound round at the top, bear a strong resemblance to, and most probably furnished the first idea of the fluting of those shafts so ornamental in the Grecian copies, while in the binding of the reeds we may easily trace the astragal and necking of the column. The square flat stone placed on the top of the pillar, and the Grecian abacus are synonymous, while the flat stone upon which the Egyptian columns rests, fully accords with the plinth of the Athenian column. The absence of the plinth in some of the pillars of the Egyptian temples, probably prompted the architect of the Parthenon to observe the same omission. The swelling shaft in the temple of Karnac, suggested the similar form in the Grecian Doric. The introduction of human figures in the place of columns at the Memnonium, certainly dictated to the Greeks the

similar application in some of their edifices, which they, claiming the originality of the design, called Caryatides. The most eminent writers assert, that this design was derived by the Greeks, from the Carian slaves carrying on their shoulders heavy burthens, and hence the name but certainly the similarity between these figures, and the more ancient ruins of Egypt, could not have been accidental. The capitals of the columns of the Temple of the Winds at Athens, bear a very strong resemblance to those of the temple of Appolonopolis. This strong analogy might be pointed out to a much greater extent, but sufficient has been adduced to establish the existence of the similarity.

In Egypt, then, may be traced the characteristic features of many of those splendid temples, which Athens boasts, and which have justly attracted the admiration of the world. To the Egyptian ruins, we owe many of those ornamental details of Grecian architecture, which the practice of centuries perfected, and which all the talent of succeeding ages could not improve. But why almost all authors award the palm of originality, and attribute the cultivation of the first principles of architectural knowledge, to Greece, seems a problem exceedingly difficult to be understood. Why, while merit and praise is heaped, and justly too, upon the perfectors of known principles, should we deprive the authors of their well-deserved meed of admiration? and while we, in some measure, and to a certain extent, agree with many writers, that taste and beauty of design are the attributes of the three orders of Grecian architecture, should we go the lengths which they would wish us, and brand those stupendous monuments of the by-gone glory of Egypt, as the very infamy of taste, or as Strabo has pronounced them, "barbarous monuments of painful labour."

It is not to be wondered at, that during the long period, in which architecture flourished in Egypt, greater progress was not made, and a greater diversity of design observed, when it is remembered, that to the management and supervision of the priesthood these erections were entrusted. This religious scruple and bad selection of superintending power altogether tended to curb the talent of the people, as the science was placed in the hands of a body of men, whose profession must have chiefly engaged their attention, and who, if ever possessed of architectural taste, were themselves so restricted by forms, as to render that taste useless.

F. V. C——, A B, Arc., C.F.

Dublin, 13th Nov, 1843.

ANCIENT STRUCTURES IN WINCHESTER AND ROMSEY.

By Mr. George Godwin, F R.S , &c.

It would be difficult to name a locality more interesting to the architectural antiquary and the lover of old memories, than Winchester and its neighbourhood. It is connected with some of the earliest events in our history, and with many of the most eminent men of past time, who have left there enduring monuments of their own energy and ability, and of the prevailing spirit at particular periods of time. Thanks to steam and engineering skill, which in several respects may be said to have doubled the length of man's life,[1] Winchester, although 61 miles from London, may be reached in two hours and a half, so that there is now little difficulty in paying it a visit.

A history of English architecture might be illustrated very satisfactorily from the Cathedral alone, in addition to which there are the College, the city gates, the County Hall, the Market Cross, the remains of Hyde Abbey, two or three parish churches, and the Hospital of St. Cross,—which are all full of interest and instruction. As I have said again and again, architecture has a history more exciting and instructive than half the moral essays and poetical fictions ever penned: it is, in fact, the history of society written in brick and stone.

The age of some parts of Winchester cathedral has excited controversy, nor is the question yet settled. The original foundation of a cathedral here is ascribed to the second century, the structure then raised was rebuilt at the commencement of the 4th. In the middle of the 7th century it was again renewed by Kenewalch, an intimate friend of Bishop (by whom the arts in England were much advanced), and in the 10th century Bishop Ethelwold rebuilt great part of it. The present cathedral was commenced by Bishop Walkelyn in 1079, and dedicated 14 years afterwards and according to the generally received opinion the crypt, the tower, transept and font, belong to this era. Mr. Garbett, however, and some others, have thought that portions of the structure are of an earlier date than this: nor can I entirely refuse to coincide in this opinion. The tower, Rudborne, the Winchester annalist, states repeatedly, is the work of Walkelyn. That part of the north transept which adjoins it is seen, from the execution of the masonry, to be of the same date; but the remainder of the transept more northward has a widely different appearance, and is unquestionably the work of a different period. The mortar joints are considerably larger and the execution altogether ruder, nor is the design exactly the same, or the parts of the same height, so that management was required (and is evident) to bring the two portions satisfactorily together. My excellent friend Mr. Britton,[2] in his History of Winchester Cathedral, considers "this might have arisen from different workmen who were employed, even at the same time, and still more from those who were engaged on the church at different periods of its erection, for it cannot be doubted," he continues, "that in edifice of this size must have been some years in progress, and that many masons were unquestionably employed in its construction." With the greatest respect for the opinion of our veteran topographer, and every disposition to look with caution at any assumption of remote date, I am unable to think this argument conclusive in the present instance. If this difference in the workmanship had appeared *horizontally* throughout the building—if the lower story presented one appearance, the upper part another—this opinion might be tenable; but in the case before us, the difference is perpendicular, it is throughout the height of a particular portion, not the length of the whole; and before we can admit that the diversity of construction which is apparent, results from the different workmen who were engaged on the church at different periods, we must believe that one half of the north transept was completed before the remainder and the tower were begun.

The statement of Rudborne, too, which is urged as proving the entire rebuilding of the church by Walkelyn, is not sufficiently conclusive to destroy an opinion founded on what we see before us. He says that Walkelyn, *a fundamentis cœpit reædificare*, words which, if I mistake not, have been used by chroniclers in some cases where it was known that much of the previous building had been allowed to remain, although the whole had been reconstructed even from the ground. In fact, that some part of the old cathedral at Winchester was allowed to stand, seems clear, from the continuation of Rudborne's own narrative, for he goes on to say that within a year after the completion of the new building, the Bishop's men destroyed the old monastery, *excepto portico uno, et magno altari*, or, as Milner words it, "leaving nothing standing at the end of the year except the high altar and *one porch*, which seems to have been the corresponding part, or eastern end of the cathedral church." The word *porticus* has a doubtful signification, but unquestionably means more than what we should now call a porch.

In pursuing this investigation, there is another circumstance recorded which must not be lost sight of, by which (if other discrepancies could be removed) the difference of workmanship in the transept might be explained. The eastern end of the church (which Milner considers was of Saxon work, left by Walkelyn) had become dilapidated in Bishop Lucy's time, and that prelate determined to rebuild it, beginning with a tower. In the year 1200, according to Rudborne, this tower was begun and finished. It does not seem probable that the centre tower was here referred to; it would be inconsistent with other of the annalist's own statements, and moreover the style of the architecture is clearly anterior to that date. Garbett considers it was a tower at the eastern end of the choir. The whole matter, however, is wrapped in doubt, and it would be safer to say that one portion of the transept was early Norman, the other late, but for my own part, I can hardly avoid considering that the northern extremity of it may be anterior to the conquest.

The effect of the transept, massive and grand, is very striking, and will well repay attentive study; the arrangement of the aile at the termination north and south, is peculiar. The elegant nave, of a very different period, and consequently with a very different aspect, is the work of William of Wykeham, commenced about 1393, when he was seventy years old. It affords some excellent examples of "perpendicular" Gothic, as, indeed, do many other parts of the cathedral. Recent repairs have served to prove that much of the old work was allowed to remain by Wykeham, and was cased and altered.

[1] The magnitude of the cuttings and embankments which form the railways of Great Britain, looked at as a whole, is enormous and would seem the work of ages, yet all this has been effected within a very few years *by single-handed* continued efforts, however small singly, work wonders.

[2] Mr. Britton to whom every student in architecture, and many beside, are deeply indebted, celebrated in July last his 72nd birth-day. Time has in no way diminished his energy or ardour, or lessened that kindness of heart which has led him, throughout a long and useful career to offer a friendly hand to all whom he thought deserving. Honour be to him!

In sepulchral chapels Winchester cathedral is particularly rich, especially in those of the perpendicular period. The eastern portion of the building, behind the altar, is a perfect *rendezvous* of monuments, perhaps unequalled, and must be seen to be duly appreciated. Bishop Fox, Bishop Gardiner, Bishop Waynflete, and Cardinal Beaufort, have chantries here; Wykeham's chantry and Edington's are in the nave. A sculptured figure in a *vesica piscis* has been recently affixed to the east wall in the north transept. It seems formerly to have been loose in the cathedral, for it is represented on the ground leaning against a pillar, in one of the plates in Mr. Britton's history.

The most interesting of the parish churches in Winchester is St. John's. It consists of chancel, nave, and side ailes, and has a tower at the west end of the north side. This structure contains most of the features which distinguished our places of worship "while yet the church was Rome's," and concerning which all information is now sedulously sought. Where the rood-loft formerly stood to separate the chancel from the nave, is now placed the organ gallery—most improperly. The staircase by which the priest ascended to the rood loft is in a turret against the south wall of the aile, with a doorway in the wall; over the aile there was formerly a gallery or passage way to the loft, with openings through the spandrels of the main arches. There was an external entrance to this turret, which was probably used as the "priest's door" to the church.

Two projecting walls from the east end separate the chancel from the ailes, and in that on the south side is one of the small, oblong apertures, opening obliquely to enable those persons who were in the aile to see the elevation of the host, and which have been termed *hagioscopes*. If my memory is right (I have no note of it) this was adapted to serve also as a piscina, an arrangement not uncommon. In the wall on the north side there is a similar oblong opening inclined the reverse way, so as to admit a view of the east end of the north aile, where there is a handsome altar tomb against the north wall, with a recess above it, which may have been used as an Easter sepulchre. If so, lights were kept burning in it during the latter part of Passion week, and the opening in question may have been made to enable the attendants readily to watch them. On the side and end of the tomb[3] are shields, one bearing the five wounds, another the instruments of punishment, and a third the letters I.S. entwined, standing probably for *Sanctus Jesus*, or *Jesus Salvator*. Returning an instant to the chancel, there is one sedile and a piscina on the south side of it. It may be well to remark that although I have described the church in this memorandum as standing east and west, the altar points in reality to the south east.

At the church of St. Peter, Colebrook (at the same end of the city as St. John's) where the tower is at the south-east corner, there seem to be remains of enriched ridge-tiles. The font is square, supported on a central pillar with four smaller pillars at the angles, similar in plan to the very interesting specimens of Norman fonts at the cathedral, the church at East Meon, and other places also in Hampshire.

The County Hall, formerly part of the old castle, although now encumbered by the Assize Courts, has many points of interest. Milner calls it, "the ancient church or chapel of St. Stephen;" but Mr. O. B. Carter, architect, who has examined this building lately, and has prepared plans for its restoration,[4] considers that it was always used as a Hall. It is in three ailes divided by clustered columns and arches, and must have formed a magnificent apartment.

The Hospital of St. Cross, the "alms-house of noble poverty," which stands about a mile from the city, retains more fully its ancient appearance and customs than any similar establishment in the kingdom. The brethren with their black gown and metal cross on the left breast, the dining hall with the old "black jacks" for ale, and other implements given by Cardinal Beaufort; the quiet cloister, the ancient church embowered by trees, and the pretty residences of the brethren around it, serve to take back the mind to a much earlier period in our history, and to induce the thought that in a rude and violent age the monastery—which St. Cross, though never so used (being simply a hospital and a refuge), closely resembles—must have offered strong attractions to all studious or timid men, who were unwilling or unfitted to encounter in the world the more boisterous spirits of the time.

Originally, besides the resident brethren, 100 miscellaneous poor were fed daily in what was called, in consequence, "Hundred-Menne's Hall," but is now a brewhouse. At the present time all who apply at the gatehouse may receive a horn of beer and slice of bread, that is until two gallons, the day's allowance, have been expended; nor are the applicants for this, few.

[3] I call it a tomb, because there seems to have been an inscribed brass around the top edge of it.

[4] Mr. Carter has recently erected the Alms-houses of St. John, in Winchester, for 14 inmates. They form a tasteful pile, and cost £3600.

Cardinal Beaufort, of whom Shakspeare says, in the bitter picture he drew of him,

> "Henry the Fifth did sometime prophesy—
> If once he come to be a cardinal,
> He'll make his cap co-equal with the crown;"

expended much money on St. Cross, amongst other charitable establishments, and erected many of the present buildings.

The church, commenced by Henry de Blois, brother of King Stephen, about the year 1136, is an interesting specimen of a transition period in architectural history, when the semi-circular arch was about to give place to the pointed. It has acquired considerable notoriety from the circumstance that Dr. Milner, following a suggestion thrown out by the Rev. J. Bentham,[5] has appealed to the interlaced semi-circular arches in the choir, where pierced for light, as being probably the first open pointed arches in Europe. The origin of the pointed style of architecture is still as doubtful as it was before the appearance of any of the numerous dissertations to which it has given rise. Nevertheless, the inquiry cannot be deemed useless: as in the pursuit of the philosopher's stone and *elixir vitæ*, the enthusiast alchemist discovered many new substances and enlarged the science of chemistry, so, in the vain pursuit of the origin of the pointed style of architecture, much valuable information has been gathered.

Whichever theory may be the most correct, it is certainly not that deduced from the intersecting arches at St. Cross. Apart from less obvious objections to any deduction founded on the present appearance of this arcade, the main arches in the choir, *below* it, are pointed, as too, is the vaulting of the aisles; by which we must be led to believe either that considerable alteration was made in the choir at a later period, when the practice of the pointed style was more advanced, and which might have extended to the interlaced arches in question, or that the date of its original construction is somewhat more recent than that usually assigned to it. Moreover, other structures in England, the date of which is asserted to be even anterior to that of St. Cross, as, for example, Buildwas Abbey, display likewise an intermixture of pointed and circular arches. The circumstances, however, which occurred in many cases to delay ecclesiastical buildings for years after the recorded date of their foundation, and the difficulty of detecting alterations and reconstructions made at a remote period, prevent us from arriving with any certainty at a satisfactory conclusion.

At the south side of the altar at St. Cross there is a table of prothesis, or credence, on which the bread and wine were placed previous to the offertory, and the introduction of which in modern churches is strongly insisted on by the Cambridge Camden Society. There seem to be very few ancient examples remaining.[6]

Romsey Abbey church, a few miles from Winchester, is a building of the same class as St. Cross, and displays an instructive mixture of the peculiarities and style of various successive periods. It is a cruciform building of considerable size, with a square tower at the intersection of the nave and transept,[7] and when viewed from the neighbouring hills, rises above the houses clustered around it, and forms the most important part of the town. It is curious to contrast, especially in a constructive point of view, the churches built by our forefathers and ourselves. Anciently every small village could boast a sound substantial church of stone, which in most cases has kept its promise of long endurance, and still serves to give stability and importance to localities which, but for this, had lost their identity long ago. At the present time little heed is given to the future; the immediate wants of the day are supplied for the most part by cheap and flimsy structures which cannot be expected to outlast the present generation.

[5] Bentham says, in his History of Ely Cathedral Church, 1771, when speaking of the origin of pointed arches. "Some have imagined they might possibly have taken their rise from those arcades we see in the early Norman or Saxon buildings on walls, where the wide semicircular arches cross and intersect each other, and form thereby, at their intersection, exactly a narrow and sharp-pointed arch. In the wall south of the choir at St. Cross is a facing of such wide round interlaced arches by way of ornament to a flat vacant space; only so much of it as lies between the legs of the two neighbouring arches, where they cross each other, is pierced through the fabric, and forms a little range of sharp-pointed windows: it is of King Stephen's time; whether they were originally pierced I cannot learn."

[6] According to Milner the church of St. Cross is 150 ft. long. The length of the transept is 120 ft. It is cruciform, has side ailes, and a large square tower at the intersection.

[7] "The length of this church, according to the curious description given in the addenda to Brown Willis's Mitred Abbies, is 240 ft., and its width, that is to say, the length of the transept, 120 ft.; his words are—'Ecclesia de Rumescye, de fundatione regis Edgari, continet in longitudine circa 90 *steppys*, et parum ultra; item in latitudine continet circa 40 *steppys* meos.' The height of the tower is about 120 ft and that of the body of the church is said to be 80 exactly."—*Spence's Descriptive Essay*, p. 37.

Romsey Abbey-church was founded in the 10th century, but there does not seem to be reason to believe that the present building has any parts of that date. The most ancient portion of the church as it now stands, is probably the work of the same Henry de Blois who built St Cross, in the middle of the 12th century. It is remarkable for having a small chapel with semi-circular absis, on the east side of each arm of the transept. The ailes of the choir likewise terminate in a semi circular absis formed in the thickness of the wall, so as not to show externally. The choir, now used for divine service (which doubtless originally terminated in a similar absis) and the transept, are Norman the greater part of the nave, excepting the walls, is of Early English. The west end contains a singularly lofty triple lancet window. According to those who maintain the necessity for symbolic design in churches, a triplet, which they consider to represent the Trinity, should be confined to the east end, to place it at the west end, they say, is a decided fault. We have here one instance, at all events, and by no means a single one, that this was not always recognised by our forefathers.

In the south wall of the nave next the transept, one of the original Norman doorways remains, and is now used as a window. It presents a series of concentric arches adorned with various sculptured enrichments, and supported by two columns on either side, with enriched capitals. In the external wall of the south transept, next the door, is a curious sculptured figure of Christ on the cross, about 5½ feet high, with a hand from the clouds above pointing to it Near it is a small recess in the wall, probably to receive a lamp or taper. The present appearance of the east end of the choir internally is very picturesque, and may be advantageously studied. Some of the capitals in the ailes, at the east end, are sculptured with figures of singular appearance, and have led to three communications to the Society of Antiquaries, printed in the "Archæologia."*

The font is square, supported on five square pillars panelled In minute points of interest this church is abundant. There are several interesting monuments and monumental slabs, some of which present curious examples of crosses and crooks. Unfortunately the names of the persons whom they were intended to commemorate, have, in too many instances, disappeared

> So perish monuments of mortal birth
> So perish all in turn, save well recorded worth."

Amongst the modern works, the last effort of Flaxman, a monument to the memory of Henry Viscount Palmerston and Mary his wife, should not escape notice It is to be observed with much regret that this interesting building is, in many parts, in a very bad state of repair and that unless some efforts be made to maintain it before decay proceed much further, but little of this structure will remain for succeeding generations.

In the foregoing brief remarks, the writer has had occasion to allude incidentally to symbolic architecture, and he cannot avoid availing himself of the opportunity which here offers itself to add one observation in connexion with it He has been accused by some influential persons of having in "A Chapter on Church-building," (published in the *Civil Engineer & Architect's Journal* and afterwards reprinted in some of the daily journals) urged the super-eminent importance of symbolism, and the desirableness of the re-introduction of details, and arrangements fitted only for the Romish faith. Now if this were his opinion, he would feel no hesitation in respectfully maintaining it

> "Hold my Lord, for my opinion bleed
> Opinion shall be surgeon to my hurt,
> And keep me on the side where still I am"

but it is not so. The little paper in question contained, it is true, a *resumé* of the opinions to that effect recently urged by some ecclesiological writers, but the motive of the paper was rather to utter a protest against their reception than to urge their adoption, as he ventures to think must be quite evident to those who have happened to read the whole of it. To quote one sentence from the paper in question "We would most worthily adorn the house of God, to render it, to the extent of our means, fitting for its high purpose, but at the same time we would carefully avoid all proceedings, however agreeable to our temperament, however enticing to us as an artist, which should give undue importance to bricks and stones, and man's inventions and devices, which should increase the number of ceremonial observances, which should threaten to exalt the shadow in the place of the substance, and so lead to a state of things which did once result from such a course, and may result again, notwithstanding the increased amount of information possessed, and the general comparative enlightenment."

* From Dr Latham Vol XIV p 136 from Sir H C Englefield, to low-in the former and from W Latham, Esq, Vol XV, p. 304.

BRITISH MUSEUM.

Sir—I have heard, upon what I consider tolerably good authority, the information coming to me at only one remove from the party himself, that a Mr. B., a gentleman in the University of Oxford, is getting up a design for the British Museum, in opposition to Smirke's; and intends to bring it before the Trustees in such manner that they cannot possibly avoid formally noticing it in some way or other. Yet, although I do not question the truth of this as far as mere *intention* goes, I doubt very much indeed if anything whatever comes of it.

With whatever ardour and alacrity they may be projected, enterprises of the kind are apt to break down very soon, and the mercury of zeal to sink very quickly from the boiling point to zero. Even well-wishers to it must consider such an attempt on the part of an individual, somewhat Quixotic; the greater probability, therefore, is that nothing more will ever be heard of it.

Although I agree with many others that the design actually adopted is almost the very last which ought to be so, I certainly cannot agree with your correspondent Dr. Fulton, who recommends the Egyptian style as a very suitable one for the occasion. To me it appears eminently the reverse, for that style is not only not a national but not even an adoptive one, nor at all naturalized among us in the slightest degree. I do not say it ought never to be employed by us, for any purpose, or under any circumstances, but I certainly am of opinion that to employ for a public and national structure what is not even an European style, would partake of absurdity, notwithstanding that the Museum contains a great number of Egyptian antiquities. Even a Gothic façade would quite as well agree with the interior of the edifice.

In regard to this last remark, it may be said that Sir R. Smirke's own façade will prove a better index to the interior, and prepare strangers better for the taste there displayed, than a design which, by rendering the exterior more imposing, would be a sort of architectural imposition, and lead people to expect a corresponding degree of architectural beauty within, nor is there any denying that such is in some degree the case. Still there are attractions of another kind within, and that they are reckoned all-sufficient is evident, for, with the exception of the Royal Library, no part of the interior makes any pretension to architectural effect or beauty. The staircases—where, if no where else, some display of the kind is apt to be looked for—are remarkable for nothing so much as their ugliness. they might be all very decent and tolerable in an hospital, but in a national museum they are abominable.

Some of your "contrumperies"—as Mrs. Malaprop would call them—have expressed a hope that Smirke would, on this important occasion, give us something at last truly noble, and a perfected design worthy to rank as a work of art. Yet, however well-meant, this is surely preposterous, for how is a man to give us all at once what all his other works—the occupations of a lifetime—prove him not to possess in the slightest degree at any rate only in the lowest degree. You might as well hope to turn a brewer's drayhorse into a racer in his old age. These remarks are, I must own, not particularly courteous, but Sir Robert Smirke may consider himself very lucky, if he be not doomed to hear by and bye others far more galling—such as will cause him to curse the British Museum and the hour he became connected with it.

I remain, &c.,

J. W. R.

Mr. Editor—I can't for the life of me make out why you and some others should be getting up such a precious rumpus 'bout the British Museum. We John Bulls want none of your outlandish Germany doings—none of your Glyposticks and Wal-fiddlesticks—none of your Polly-Stiles and Polly-Crome—in short, none of your arrant paganism—your *base*-reliefs and *frisky*-painting—all which I take to be exceedingly expensive; but merely something smartish as one may say, yet that will not make our pockets smart for it.

Now, to my mind, there is a capital model to go by, all ready cut out for us, and a real Museum it is too, into the bargain, though not such a big bouncing one as that in Great Russell Street. I mean the one in Lincoln's Inn Fields now that I call a tasty, sensible sort of a thing—genteelish and quite tippy. What the inside may be I can't say, for there, as I'm told, they let in only the quality people, but it looks a snuggish, comfortable-like place enough.

As to the Big British, 'tis of no use for you or any other body to make a botheration 'bout it now, 'cause the *face-head*, as you call it, is begun, and getting on swimmingly, so you may as well all hold your tongues.

One of the Million.

THE PHILOSOPHY OF CORAL FORMATIONS, AND THEIR ARCHITECTS.

No. III.

The ocean is the mother of earth, the fruitful womb of production, the *living principle* embodied in forms defined, being the unceasing architect of substance. Generated from the elementary compounds of air and water, living creatures are produced, having peculiar generic character, the maintenance of form and quality depending upon climate and association, or, the more uncommon incident, accident of birth. With the change of climate and association, organic bodies undergo a change, genera dividing into orders, orders into species; thus the earth multiplies in all its parts, quantities, and qualities, by the action of the living principle manifest in living forms, and in the multitudinous changes continually taking place in the fossil and mineral kingdoms. From the sea weed to the sponge, from the sponge to the lime-secreting polyp, from the polyp to the molluscous animal, from the invisible animalculæ to the whale, from the fish to the insect, the bird, and the beast, from the plant to the animal, and from the minutest spark of life to man, the great chain of life is inseparable.

In the varying strata of the earth, man may see broadly and distinctly marked, epochs of creation—and epochs of destruction—a series of ages succeeding each other—of generations succeeding generations—of climates succeeding climates—of local and general changes and catastrophes. Every region of the waters opens to the inquirer new and beautiful truths of nature, attests to the forming powers of organic bodies, and speaks of changes to which all species and all individuals are necessarily subject. The coral formation, its varying composition and character, and the sequence of events or manifold changes accompanying it, is as plainly delineated in the chalk, oolitic, and limestone ranges traversing the surface of the earth, as it is in the waters of tropical seas: the one and the other tell the same truthful tale, of myriads upon myriads of bye-gone existences, of fossil animalculæ and animals, of species analogous to or identified with those now living within the waters, whose being and existence as fossil or mineral bodies assure us of long uninterrupted periods of repose, of sudden and violent catastrophes, and of causes necessary to effect the end proposed. In the coral rag of the British strata, in the lias and other formations, we find an association of species peculiar to warm tranquil seas, their aggregate masses tell of an uninterrupted succession of generations, their sudden extinction, of sudden catastrophes, produced by changes in the position of the earth's surface, and consequently cessation for a time of living action in those regions affected by the change: all distinctly define, by their composition, character, and association, the inviolable laws by which oceanic, lacustrine, and terrestrial life is governed in distribution and change.

Mr. Darwin, treating largely on this subject, observes, "from the limited depths at which reef polypifers can flourish, taking into consideration certain other circumstances, we are compelled to conclude that both in atolls and reefs, the foundation on which the formation was primarily attached, has subsided; and that during this downward movement, the reefs have grown upward." The conclusion he comes to is as weak as is the evidence from whence he has derived it.

Of the largest lakes disposed within coral groups, such as the Atoll Suadiva, which is 44 miles long and 34 broad, enclosing a great expanse of water from 250 to 300 feet deep, other and more extensive views may be taken of their mode of formation. We have not yet to learn that the bed of the ocean is full of inequalities, resembling in this respect terrestrial earth: its hill and mountain chains and groups are of great extent, and vary much in their general composition and character; it has its extensive plains and deep valleys, and its lands favourable or inimical to life: the mountain heights of the earth, represent the bases of the submarine mountains, the one and the other, in the absence of the requisite degree of heat, being incapable of producing or sustaining life, for even in tropical seas, there are regions in which neither plant nor animal can exist: the filling up of the lower depths must therefore depend upon the matters continually carried into them by currents, or which are precipitated from the waters above them. The lowest region where life is produced, is analogous to the boundary of vegetable existence on the Hymalayas or Cordilleras, sustaining species of the simplest organization, wholly devoid of lime and purely siliceous; the next region is productive of other species, and to this succeeds a region wherein animals secreting calx and other peculiar earths are present in more or less abundance. Mr. Darwin contends, in vain, that the polypifers do not build from greater depths than 200 feet; for although their growth is protracted, and the number of species curtailed within the lower regions, still we are assured that calyx secreting polypifers exist in beds at or near 2000 feet in depth, and it is these artificers that lay the foundations and pave the way for the madriporæ and milleporæ, shell fish, crustaceæ, &c that complete the structure. On the bosom of submarine mountains the polypifers commence their work, and precluded from descending within deeper and consequently colder regions, they spread themselves upwards, right and left, as they are enabled to do from the nature of the soil on which they rest: if building on a clump of submarine hills, the valleys can only be filled up by other means, far slower than those of organic action, consequently, the structure rises as a great amphitheatre or encircling reef, having openings caused by openings at the foundations, by tidal action, and by local depositions of sand or marl. At other times numerous structures slowly arise independent of each other, or united as so many links in the great chain. The atoll formed, the openings admit the tides, which carry many substances into the lake, and by their rotary motion contribute to prevent the coral from growing within the encircling reef.

That the inequalities of the ocean bed as well as tidal action give form to the barrier, is demonstrated by the Great Chagos, which is about 90 nautical miles in length, and 1 in width; its banks consist principally of rock covered with sand, arranged so as to form a great basin, the central part consisting of a vast plain covered with marl intermingled with shells and marine relique; it slopes outwardly to unfathomable depths: now a circle to this extent cannot for a moment be imputed to volcanic causes, nor does it appear that it could have been formed otherwise than by being carried round the surface of a vast track of table land, elevated far above the lower plains of the deep. The phenomena of the African and Asiatic deserts give some idea of the mode of formation of atolls. We there find valleys varying in size, surrounded with amphitheatres of hills, the very counterpart of atolls now formed and forming in the Red Sea, the Indian Ocean, and the Pacific: chains of hills nearly 2000 feet in height and hundreds of miles in length, consisting almost wholly, (from the base to the summit,) of calcareous matter, beds of coral, of shell fish, &c., all united in the general mass, strata with strata. Many of these chains of hills are wholly calcareous, and consist of corals and other lime-secreting species; they are nearly uniform, rising 200 or 300 feet in height, above extensive plains of sand, gravel and marl, the amphitheatre having seldom more than 1 or 2 openings leading into the valley, which is generally level with and consists of the same materials as the plains; although there are often several openings ranged at different heights: the soil of the valleys is in fact at all times indentified with the soil of the plains now disposed within the Red Sea, being a greyish marl, (which Darwin very unphilosophically terms mud,) combining with vast quantities of shells and other marine exuviæ, and some of the valleys have been explored to the depth of more than 150 feet, without meeting with any other material. Again, we have islets and islands formed of peculiar species of shell fish and polypifers, clumps of tubiporæ, upwards of 30 feet high and of great width, solid masses of rock formed almost wholly of serpularia, hills of mummullites bounding the Nile, and vast mounds of sea-weed blended with salt and calcareous matter. If, therefore, the reef, the islet, and the atoll sink as they are built up, why have all these vast tracks been elevated? and why are the many thousand islets and reefs within the Red Sea continually nearing the surface and rising above it? Many of the mountains forming the African chain are also of vast height, and wholly of calcareous formation: none of them present a growth of one continuous family throughout the whole extent, but all demonstrate the vast depth of the calcareous or solid limestone formations: between these mountains and the sea the plains in many places embrace a vast area, and while the mountains show that their bases have formerly been washed by the sea, the plains demonstrate their organic origin and end in a fringing reef, which in some places is wholly removed from the action of the sea, in others, is still laved by the waters, and contains many singular grottos of dead coral, rising from 15 to 30 feet from the beach: the beach is of fine shell sand, and gradually shelves into the waters.

If, as Mr. Darwin would lead his reader to infer, the reef gradually sinks as it is built up, there is nothing to prevent its being uniform to the depth of many thousand feet, but the revealed reefs of chalk, limestone, and oolitic formations of terrestrial earth tell a widely different tale, for even the most solid limestone rock is formed, not of one but, of numerous species, of numerous families, of countless individuals, and of the atomic particles of these countless myriads which have undergone decomposition, all of them possessing the same elements, and consequently in their union in the fossil and mineral kingdom, producing the one result, under its several forms of carbonate and sulphate of lime. Where the reef is built up by living polypifers, there the valleys and plains are built up also by broken coral, calcareous depositions and sands; but, unless aided by tidal contributions, the latter advance towards the surface far more rapidly than the former: aided by tidal action sandbanks form, filling the lower depths, capping submarine mountains, or forming mountains of themselves, as is the case most particularly in the Atlantic Ocean. It is to the vast deserts of the earth, virgin islands, and fossil formations, existing under every latitude, that Mr. Darwin has to look for an explanation of coral atolls, islets, islands, and barrier reefs; he says we cannot believe that the broad summits of mountains lie buried at the depth of a few fathoms, and he asks in his simplicity where we can find terrestrial mountain chains many hundred miles in length. A slight glance at the map of the world will answer the latter question, and the very child in navigation will inform him, that the irregularities of the ocean bed are

analagous to those of terrestrial earth, that they form hill and mountain chains and clumps, and consequently valleys and extensive plains there is no reason required why their summits do not appear above the waters, the sand bank and the hidden rock are quite sufficient proof that they are there The fishers of the Mediterranean tell us that coral is found, even in those latitudes, growing at the depth of 900 feet, therefore, if heat necessary to its existence propagation and increase, is here manifest, how much deeper have we a right to expect it in tropical seas Were the great barrier reefs and atolls uniform in their growth and material, from their bases to the surface of the waters, and was this sinking strikingly manifest in all coral regions, then might we embrace Mr Darwin's hypothesis but when we find the whole earth we inhabit intersected and covered with like formations, we are naturally led to conclude that nature perfects her works without violence he very candidly tells us that he cannot furnish, nor are we to expect proofs of continued subsidence, and so says Mr Lyell, when he talks of elevatory force in action

The polypifers build in regions adapted to their nature and bearing in mind that lime-secreting animals cannot exist without heat if perchance, they do without light, which I much question, we must conclude that Malte Brun is in error when he asserts that light only extends 270 feet in depth, and that heat extends but a little farther. The temperature of the ocean diminishes as we descend, much in the same manner as it decreases as we ascend elevated portions of the earth, and the same laws of nature which regulate the distribution, habits and characters of species, are applicable to both It matters little to the philosopher whether the coral reef, islet or islands, or the vast amphitheatre existing within tropical seas (unwisely termed atolls) are built by one or by 1000 species of polypifers we feel assured that they are built, that they rise unequally, that they continue to increase, that in composition and character, in form and disposition, they resemble the calcareous formations of the earth now far removed from the ocean as is demonstrated by the vast regions of Africa and Asia and that they are continually adding to the earth. Upon examination we find certain species of hardy madrepores rising to the level of the tide and bidding the breakers defiance, that almost invariably they replace some species and give place to others, that at nearly the greatest depths sounded, some of these lime secreting species are found, and that every region, beneath every latitude has its peculiar vegetation, or peculiar animal species The polypifers, checked in their growth by currents and depositions of sands build laterally, towards the surface of the waters, to the right and to the left In the shallows of the Red Sea there are numerous circular reefs formed exclusively by one particular reef species throwing their branches out on every side, in the valley between these reefs, formed by clusters of such reefs, we see a variety of species in solitary clumps, or intermingling with each other, and apparently struggling for existence, but however circular the reef may appear above the waters, this peculiar form soon ceases beneath, for on that side of it not affected by the currents, and in very quiet parts within the barrier or encircling reefs the growth of the coral is nearly uniform and the spaces between each group becoming rapidly filled with living coral, the crowning islets always preserve their tabular appearance thus when they have spread to a vast extent, they sometimes become partially or wholly destroyed by sudden involutions of sand thrown upon them by tempests, and the whole family is thereby destroyed In general they dip with a gentle inclination into deeper waters, and sometimes they exhibit epochs of general destruction whole fields having been suddenly destroyed from which, in the course of time, fields of lesser extent again spring up to be destroyed in turn thus many of the vast atolls or islands dip by a succession of steps or ledges into the ocean depths the barrier, encircling, and fringing reefs always present one or more precipitous sides, varying from a few inches to some hundreds of feet in thickness

Ehrenberg, whose authority appears to stand high with some people, has made many unwarrantable assertions regarding the phenomena of the Red Sea, of which, from his very slight acquaintance with it he could know, and evidently does know, little or nothing He states that the corals only coat other rocks in a layer from one to two feet in thickness, or at most to a fathom and a half, there are thousands of elevated islets in this sea, and vast tracks fringing its shores, prove the direct negative to this assertion I have seen many families of tubipora standing above high water mark full 30 feet in height and many yards in diameter on every side, and there is every reason to believe that their bases, several fathoms beneath the waters, are of the like composition. He speaks of massive corals which he imagines to be of such vast antiquity that they might have been beheld by Pharoah—these are large clumps of meandrina, the growth of from 30 to 50 years; he tells us harbours fill up with sediment, sand, and shell, proving thereby that he had never visited the principal ports, I believe that his visits were confined to Massowah It is true, in calculating the growth of coral, latitude, dip and inclination, must be taken into account, and also the many destroying or retarding causes of increase of the calcareous mass, for like the grass of a meadow the gelatinous or living portion is liable to be continually cropped by the coral and other fishes, which continually feed upon them.

The experiment of Dr Allen, of Forres, as related by Darwin, who, having 20 species of living coral of 10 lb weight each, found that after seven months they had become immoveably fixed, and many feet in length, stretching in the direction of the parent reef, is a demonstrable proof of the rapid growth of many species of reef coral, again, the relation of Lieut, Welstead, in which he says, that a ship in the Persian Gulph had her copper bottom incrusted, in the course of 20 months, with a layer of coral two feet in thickness, which it required great force to remove, also, the incrustation of anchors and other substances exposed for a short time in deep waters, are further confirmation of the rapid growth of coral under favourable circumstances Captain Moresby speaks of knolls, in the Maldiva amphitheatre, of not less than 100 yards in diameter, and 250 feet to 300 feet deep, and in the shallows of the Red Sea these knolls are beyond number, consisting of branching madrepora of one particular family, growing up like one huge pillar with branches radiating from every side, and festooning from the summit, knoll with knoll, until they fairly entwine with each other, the general structure has been formed by the successive growth and death of individuals, or from the base of the trunk and lower branches, madrepore or millepore having consolidated It is not from the branches being accidentally broken off that the reefs receive increase, but principally, from the general struggle for existence of species with species, thus, if the red coral attain the height of three feet in 10 or 15 years, other species springing up immediately around its base, enclose it within their stony folds, and they in turn, become buried beneath rising generations thus the millepora in the Pacific encroach upon the porites and millepora complanata, and the latter upon the strongly branched madrepora Matilda atoll, described by the crew of a wrecked whaling vessel as "a reef of rocks," was, when Captain Beechey visited it 34 years afterwards, a lagoon island fourteen miles in length, and having one of its sides covered with high trees and although, from disturbing causes, some of the islets and islands of the Red Sea do not exhibit a sensible increase during a long interval of time, the native dwellers on the coasts relate many remarkable instances of addition to the main land, and to islands which they resort to for the purpose of fishing for pearl, and tortoise shell

As the tidal action gives the direction to the outside of the barrier, so does it very often, by being introduced therein, give form to the interior of the reef, the hollow or central basin, resulting from accident, being preserved from filling up by the tides and by constant depositions, which prove fatal to the polypifers and prevent their extending over the basin It is well known that almost all the large lagoons communicate with the ocean by one or more openings and by these passages the waters bring in quantities of sand and marl, which constitute in varying proportions the bottom of these lagoons, but if the encircling reef prevent the intrusion of these matters, the lagoon is soon filled up with living coral and shell fish The larger atolls, as they are termed, are, more properly speaking, vast amphitheatres sometimes formed of barrier coral, at other times of sand banks, calcareous matters and dead coral or limestone rock, the interior being very rugged and unequal, numerous islets appearing above or beneath the surface, sometimes united at their base, forming groups and chains of hills, at other times running along the shores of the main land, as though marking out its future boundary in that quarter the circular form of these reefs is a necessary consequence of their continued increase, for having fixed itself in the ocean bed without reference to the nature of the bed, the polypifers radiate on every side, as well as upwards, consequently, if no disturbing causes interfere, its assumption of the circular form is certain such indeed is the mode of growth of astræ, meandrina, and other clump like corals, the branchiform differing in giant growth alone but there is no law commanding this form, for many clumps are square, oblong, or irregular in fact, these stupendous edifices are produced by very feeble and minute creatures, of the lowest organization, powerless, and depending upon favourable circumstances of latitude, dip, and inclination for their existence and propagation, and whether they extend laterally, or around the level surface of a submarine mountain, or from clumps of rock, or sand, depends upon the chance of circumstances more than upon design. Many of the lagoons open down into the valleys of the deep, others are formed from the multiplied depredations of coral fish, adapted by the thick scaly coats to glide through the coral branches with impunity, like the more delicate corals living within the encircling reefs, feeding upon the latter, and thus retarding their growth, permitting only the more hardy and quicker growing madrepores to build up their peculiar edifices until they reach the surface of the waters.

Mr Darwin speaks of the limited depth at which reef building polypifers can flourish, at the same time he quotes Captain Beechey, who informs us that off Keeling atoll all the soundings, even the deepest, were on coral, and what I have previously stated is quite sufficient to prove that according to the laws of light and heat, which regulate their existence, composition, and character, they must exist in much greater depths than in the Mediterranean, Ægean or Adriatic seas. Most of the atolls in the low Archipelago are of an elongated form, thus, Bow Island, which is 30 miles broad, is not more than 5 miles wide, numerous other islets and atolls bear the like proportions.

CONDUCT OF EUROPEAN NATIONS TO THEIR MEN OF SCIENCE.

Project for an European Temple of Science.

SHORTLY before the present Prime Minister of England assumed the reins of Government, he delivered an address at Tamworth, highly eulogistic of the various "Mechanic" and other Institutions for improving the working classes. That address excited much attention at the time it was published, and on the exaltation of its author to power, it was naturally expected that the opinions of the Premier would take some practical shape. Such, however, has not yet been the case. Nevertheless, when it is considered what vast commercial and other measures have occupied the attention of Government—what difficulties Sir Robert Peel has had to grapple with in China, in India, in Scotland, in Ireland, & in Wales,—what a variety of complicated and conflicting interests he has had to encounter, or to conciliate, it will argue no want of zeal in the cause of science and public improvement because he has not hitherto taken up the subject. Moreover, it is but seldom that governments do take up matters that are not forced upon their notice from without. Men of science must begin the work themselves, which if they do with energy and unanimity, we are persuaded they will have no unwilling listener in Sir Robert Peel.

The Premier has expressed in terms his delight with, and his desire to support, Institutions for the promulgation of Science. Let it be our task to point out to this great statesman and to the world, what it is that would most benefit science, what it is that science most requires—what it is that would foster and furnish an impetus to the progress of valuable invention and popular improvement, beyond anything ever yet established or proposed. In a word, let us put Sir Robert Peel in the best practical way of carrying out his own professed opinions.

The late Mr Rothschild called England "The workshop of the World." Now to the extent that England has deserved this compliment she has been mainly indebted to her coal, her iron, her capital, the industry of her workmen, and most of all to the *inventions and improvements of our men of science*. Without such men as Arkwright, James Watt, Richard Trevithick, Henry Bell, Dr Cartwright, Charles Tennant, and a few others what would her manufactures or her commerce have been? The first multiplied to an immeasurable extent the products of the cotton factory, the second formed that grandest of all modern discoveries, the improvement of the steam engine, the third (his apprentice) successfully applied the great motive power of steam to navigation. Without these three men and their inventions, without the Steam Engine, without the spinning jenny, without the steam ship, where would have been our superiority in manufactures, in commerce, or navigation? To those three men we owe more of our national wealth, and our national renown, than to all other men and all other circumstances that shine in the pages of our history. Yet how was one of those three men rewarded, and what inducement is there for others to "go and do likewise?"

Henry Bell was declared in the report of a select committee of the House of Commons appointed to take evidence upon steam navigation to have been the first successfully to apply steam to navigation. He had conquered vast obstacles by vast perseverance. He proposed his plan of applying steam to navigation upon a large scale to the Lords of the Admiralty. It was with great difficulty their Lordships could be induced to listen to the proposition, and when they did so, they laughed at it. With the exception of a Scotch member of the board, who from a kindred nationality took a slight interest in the success of his countryman, there was an unanimous feeling that steam could not be applied successfully to navigation. The author of the project, nothing daunted, thought otherwise and went on upon his own resources. After a long ordeal, and a great expenditure of time and money, the "Comet" was built and sent through the Clyde to the "lochs," and the mountains of the highlands. The simple inhabitants were amazed, but not so men of science and capital. Henry Bell had not taken out a patent. He had discovered and invented, but he had no exclusive right to the discovery and invention. What was the result? Companies were formed to adopt and carry out his invention. Those companies had capital which he had not. They competed with his boat and defeated it, simply by making their boats more elegant and convenient, and what cared the traveller for the claims of the first inventor? Henry Bell had built carriages in which others already began to ride.

While the struggle was going on, Henry Bell, in his ardour for improvement, occasioned a boiler to burst, which made him a cripple for life. Nevertheless, he invented a plan for deepening the Clyde, and the magistrates of Glasgow awarded him £50 per annum for life, for the valuable improvement to the navigation of their city. Fifty pounds per annum, however, did little for a man who dedicated year by year a much larger amount to the promotion of his grand plan of steam navigation. He saw it succeed, but from it derived no benefit. At 65 years of age he found himself occupying the Helensburgh Baths, involved in debt, with a prison or a workhouse in prospect. Yes, he, the conqueror of the winds and the tides, the creator of the wealth of millions, the greatest benefactor to commerce that ever lived in this kingdom—he, aged, crippled, and destitute, applied to the British Government for relief, and his memorial was signed by 15 members of Parliament, provosts and chief magistrates of maritime districts. The late Right Honorable George Canning was then the Prime Minister, but that distinguished statesman had not made a Tamworth speech in favour of science. Henry Bell danced attendance upon him for three months, he occupied apartments at No. 22, Downing Street. Poor man, his hopes were fed but to be blasted—he was ultimately told that he was too infirm for a country Post Office, and that he could not be placed on the Scotch Pension list, seeing, no doubt, that his services were not of that "parliamentary" nature which were generally so rewarded. HE WENT HOME AND DIED OF A BROKEN HEART!

Another striking case is that of *Richard Trevithick*, a man of transcendant talents, gorgeous conceptions, and gigantic energies. Originally a miner in Cornwall, he invented, or was the first to carry into practical operation, the high pressure engine, was exalted to the rank of a Marquis and Grandee of Spain—almost worshipped as a demigod in the Indies—his inventions "annihilating space in the old world, controlling the current of the great Mississippi, and displaying the mountain riches of the Cordilleras* in the new, he returned to his own country to find support and found none—to seek for sympathy where there was nothing but apathy—possessed of princely property which he could not make available, his countrymen wondering and admiring, but none aiding or assisting—and returning many thousands of miles, "far away from children, wife, and sacred home," to perish poor, unfriended, comparatively unknown!

Now had an EUROPEAN TEMPLE FOR SCIENCE existed, could it be believed that such men as Richard Trevithick and Henry Bell would have been permitted to pine and linger out their latter days in helpless indigence? Is it right?—is it wise?—is it politic, that the great creators of national wealth should be so treated? All the common and ordinary trades and avocations of life have their asylums and institutions—why not science? Those who till lately were deemed "vagabonds" by the law, the actors of our theatres, have, nevertheless, "funds" patronized by princes and supported by *millionaires*—none for science! The very chimney sweepers are not allowed to be swept from the earth by the besom of destruction, without a society to aid and protect—none for science, *Sir Robert Peel*—"NONE FOR SCIENCE!"

Well, indeed, has it been said by a great poet —

"In the land of the North there are insects that prey
On the brain of the elk till its very last sigh,
Oh Genius, thy patrons, more cruel than they,
First feed on thy brains and then leave thee to die!"

* See Civil Engineer, vol. II, page 93, for a lengthened and interesting memoir of Trevithick.

(To be continued.)

BRIDGE OF NOTRE DAME, PARIS.—At the Académie des Sciences a communication was read from M. Fourneyron explaining the application of floodgates to one of the bridges of Paris. A committee of the municipal council of Paris of which M. Arago was president, was formed some time since for discussing the practicability of closing the arches of the Pont Neuf, or the bridge of Notre Dame with gates by which the current of the river could be regulated at will and which by raising the level at a certain part would give a fall of sufficient force to work powerful turbines for the supply of water to all parts of Paris. In 1841 M. Fourneyron submitted a plan of gates of such construction that they could be worked with ease by one man, but as it was impossible to pronounce fairly on the merits of his invention without absolute experiments the Academy and the committee of the city of Paris resolved to suspend the expression of opinion until experiments could be tried. M. Fourneyron now announces that for more than two months past one of his gates has been in use at Gisors, and that it has proved successful.

THE ESTUARY EMBANKMENT.

This undertaking was designed for inclosing from the sea a tract of most valuable land, about 4,000 acres, which will, when enclosed, be principally the property of the Commissioners of the Nene Outfall, under whose auspices the works are being carried into effect, and in which they are assisted by the professional services of that eminent engineer, Sir John Rennie. The embankment is nearly three miles and a half in length, and for some distance averages 28 feet in height, and at some parts of the line of works there is a depth at high tide of 14 feet. About one mile and three quarters, or one-half the whole length, is already completed, and from this portion of the work, as a specimen, it is allowed by experienced persons that it will be one of the best examples of a sea-wall to be found in England. The land, it is estimated, will vary in value from 40*l* to 80*l* per acre, and is a maiden soil, would be a fine site for a model farm of one of the agricultural societies of England. The works are rapidly progressing under the superintendence of Mr. H. H. Fulton, resident engineer, and the contract, we understand, was taken in August, 1842, by Mr. H. Sharp, for 60,000*l*. The Nene Outfall Commission, composed as it is of some of the most public spirited men of the day, headed by Mr. Tycho Wing, as chairman, has already effected great improvement in the condition of part of the fens of Cambridgeshire and Lincolnshire, by procuring a natural drainage for the lands in lieu of the inefficient and expensive system of drainage by windmills and other mechanical means, at the same time improving the navigation of the river Nene from the sea to Wisbech, to such an extent that formerly Humber keels of 70 or 80 tons could with difficulty reach that port, whereas now vessels of 400 or 500 tons can, without the assistance of a pilot, owing to the straightness of the channel, get up to Wisbech without the slightest difficulty. This navigation, is an artificial tidal channel, is said to be the finest of that description in the country. It was designed and executed under the direction of the late Mr Thomas Telford and the present Sir John Rennie, and so important has been the result of these works that the trade of the port of Wisbech has been trebled during the last ten years. In the course of last year it amounted to 140,000 tons of shipping, though the shipping trade was in a worse state in 1842, than it has been in for many years past.

CONCRETE FOR WALLS.

Sir—I have lately observed in your *Journal* several communications from correspondents on the subject of Concrete for Walls. They all refer to what has been done in France, as specimens of that kind of building, without, I presume, being aware that our own country can afford many examples of buildings, the walls of which are of a very similar construction. Most of the roads in Dorsetshire are formed of chalk and flints—the scrapings of these roads the people collect, leave in a heap to dry, and when about to use it, they temper it with water. Their walls are formed in a wooden frame, forming about a foot in height at a time, rather thicker in proportion than would be necessary for a brick wall. I entered several farm houses, the walls of which were entirely composed of this material, and seemed to stand well. Perhaps amongst your numerous correspondents there may be some found able and willing to afford you full particulars relative to the method employed, cost, &c., that is if you should consider the subject of sufficient interest for your *Journal*.

I am, Sir,

Yours very truly,

T. Webb.

35, *New Street*,
Nov. 10, 1843.

ON STOVES.

Sir—A letter appeared in your last *Journal*, on warming and ventilation, signed W. G., evidently written by one understanding the subject. The pith of his long letter is contained in his four last lines, where he says —"It is evident that an ordinary fire fulfils all the principal objects of warming and ventilation, better than any of the unnatural modes which science, ingenuity, necessity, or desire of novelty, has yet given birth to."

As a stove manufacturer, I have watched the various fallacious modes of warming houses without entering into the use of them, the result of my observation goes to confirm the four lines quoted. The first introduced was by Dr. Arnott, to suit every description of room, for certain places, and with proper care and attention, this is the best of all the new stoves, but for use in a room inhabited by human beings, nothing can be worse. Ill health and disease attend them, these remarks are not made through prejudice, as I have had one in use 5 years, and find it superior to any other stoves, most economical in expense, and no trouble to attend; but it is put in a warehouse, with an abundant supply of fresh air. The various stoves, Vesta, Chunk, &c., or by whatever name they are palmed on the public, are all founded on the Arnott Stove, and are non ventilators, as are all modes of warming by hot air or hot water.

It is now only requisite to obtain the support of a Doctor of something, (music would do) or the certificate of a Chemist, so worded as to say nothing, and the more noxious the vapour, the more anxious are the public to inhale it. It was stated, in 1810, that an open fire stove, with appendages, was to be placed in the British Museum, to show future generations the mode of warming made use of by the English in the present age. Will all the fallacies of the years 1838 to 1843, be deposited there? They would not do much credit to the common sense of John Bull. Excuse these remarks, they are from your constant reader, and one who combines

Ventilation with Warming.

Sir—Many of the fires that took place in and about London last winter, and a few this winter, have been attributed to the defective mode of fixing the warm air stove, or whatever apparatus the house may be warmed with, this is a stigma on the stovemakers of London, which in justice to them should be removed, the fact is simply this, the most important part of a stovemaker's business, is entrusted to persons totally unacquainted with it. A gentleman wants his hall warmed, a tradesman his shop, or a churchwarden the church he does not ascertain who will do it most effectually or economically, as regards consumption of fuel, or which man best understands his business, but who will do it cheapest. He therefore purchases the thing most puffed by the quacks, and sets a bricklayer to put it in its place. He is ignorant alike of the maker's intentions, and how to fix it: the next week the place is burnt to the ground, it is laid to the stove, the man who sold it lays it to the bricklayer, so no one bears the blame, it falls where it should fall, on the purchaser. I was once called into a case of the kind, where a hot air stove was fixed in a drying room, heated to a very great degree, and standing on a wood floor, the regret was not that the house was burnt down, but that it fell on the Fire Office to make good the loss. About eight years since, I was applied to for a design and estimate for warming a church in the city, I gave both, but they were returned to me as much too high, the parties purchased two things, I believe, called Scott's, (or some such name,) after using them five or six years, they paid me my price for fixing a stove in the church—sent their two things to the furnace, and now find they have more warmth at a third or fourth the consumption of fuel, so much for cheapness, let the parties who wish their houses warmed, employ efficient persons only to do it, and we shall hear but of few houses being burnt down by flues being overheated.

Yours truly,

A. Smith.

PRIORY CHURCH OF St. BARTHOLOMEW, SMITHFIELD.

Sir—From the circumstance of an interesting article appearing in your last number, on the parish church of Saint Bartholomew the Great, West Smithfield, I take the opportunity of directing further attention to that interesting structure.

The writer of the article referred to, suggests various Restorations which every architect must rejoice to see carried into effect, but it is chimerical to suppose that the expense which would have to be incurred thereby, could be defrayed by the parishioners. The funds *absolutely* required from time to time, for maintaining the fabric in a state of ordinary repair, are raised with considerable difficulty, and the few restorations which *have* been made, consisting of partially re-opening the Triforium, and Prior Bolton's window, were accomplished by means of a private subscription. To restore the choir to its former extent and in its original style, would, I consider, require an outlay of nearly two thousand pounds, to say nothing of the expense attendant on the alterations which such a restoration would necessarily involve, viz., the removal of the parochial schools, which are placed over the north aisle, and of an erection (used as a manufactory) situate over the east aisle.

Under these peculiar circumstances, it is useless to hope that any important steps towards a perfect restoration can be taken, unless a general interest in the subject be first excited, and although it would undoubtedly be a great boon conferred on Art, were this valuable relic of Anglo Norman Architecture restored to its primitive grandeur, I fear it is by the public only, that so desirable an object can be carried into effect.

Yours obediently,

John Blyth.

113, *Aldersgate Street, City, November*, 1843.

Admitting then, that in by far the greater number of cases an atoll consists of a simple elongated ring, we are still as far as ever from embracing the idea of the atolls being formed on the summits of volcanos as is presumed by Mr Lyell, that they cap submarine mountains is very evident that vast numbers have one general base is equally evident, thus in Marshall group many atolls are united together by linear reefs and in the shallows of the Red Sea most of them are thus united in groups or in a linear direction, the barrier reef polypifers being pre eminently the architects of the atolls and the circular reefs, formed in entirely by the one particular family Upon examining the early development of some of these encircling and barrier reefs, we find that the polypifer fixes itself almost indifferently to the level and to the slope, always affecting growth perpendicular to the plane of its position this circumstance alone must have some influence on its extension thus, for instance if it take root on the side of the sand bank it fixes that portion of the sand to which it is attached, and in growth takes the form of the upper portion of the bank, fringing it more or less all round advancing thus, and radiating towards the surface of the waters, and outwards it continues to advance while, the interior or apex of the sandbank experiences in many instances little or no alteration, the tide passing through it by constant disturbance, preventing the polypifers from extending in that direction that this is one cause of the hollow in the centre in the reef or island is proved by the nature of the material which forms the bottom of the basin which is ocean mud sand, or such matters as are cast by the waters upon the reef On the other hand many of the islets and atolls covering vast areas spring up as table land within an equal surface which have no lagoons and other lagoons when open to the sea rapidly fill up with the living coral Wherever soundings were obtained off Egmont Island and the neighbouring atolls, the bottom is found to be invariably sandy, and the currents run with great force around them, this alone is sufficient to account for the precipitous appearance of these formations, for in the live or moving sands it is impossible for the polypifers to extend their edifice over the area thus disturbed and consequently their labours are confined to building upwards

Again, there are other causes which tend to give form to the reef, thus the polypifers spread over the submarine plain, covering a large area they build upwards and attain a considerable height when a sudden evolution of sands or calcareous matter, partially or wholly destroys them if partially destroyed the disturbing causes having ceased, they again spring forth in detached groups upon the parent bases forming fields of lesser extent, and continue to advance towards the surface until a second catastrophe has the like effect thus the building arises from vast depths by a succession of steps Wherever sands can accumulate upon a bed of coral then the polypifers are necessarily subject to partial or entire destruction That the tidal currents have much influence in forming the reefs is manifest by its form and growth within tranquil waters the reefs have a gentle inclination from summit to base, the natural consequence of uninterrupted and expanding growth and in a chain of reefs they may be often seen overhanging until their upper parts meet, vast caverns or arches are formed which if not filled up with deposits from the waters may continue thus age upon age for no sooner is light and heat excluded than the polypifer ceases to perform its functions It appears evident that the law of forces is the law of growth of coral, that the polypifer taking root within a quiet area, will enlarge its parts on every side until it fill that area, embracing in its rising structure all the inequalities of that plain that if a tidal current bounds that plain at one or more of the cardinal points, and brings with it sands or other matters and thus form accumulating beds, such formations must prove natural barriers to the advance of the coral in these directions, so long as this action continues the general steepness of the Chagos and Maldive atolls is produced by these causes the uniform distribution of the reefs on the leeward side of the Mauritius and in the extensive shallows of the Red Sea demonstrating that quietude is essential to their expansion Again that where the sands or ocean marl accumulate over a given space of a reef, then without consideration of the depth the polypifers cease to build so long as the disturbance continues it is indeed an admitted fact, that the greater part of the bottom of most lagoons is formed of sediment, varying in its nature, but having the one effect the destruction of the artificers of the reef.

Mr Darwin says the islets placed to leeward are liable to be occasionally swept entirely away by gales equalling hurricanes in violence, and therefore their absence is a comparatively unimportant fact it is true that the action of the waves does often wash away so much of new islets as appears above the surface, but beyond this the most tempestuous seas can have no influence, consequently if islets did exist in this direction as he would have it understood, they would still present themselves to the view as submerged reefs, but in reality the polypifers do not extend themselves in the disturbed line, or if they do, they are very small compared with those to windward. The circumstance of there being no living coral on some submerged reef, is anything but proof that those reefs were once elevated above the surface of the water, but is rather demonstrative of the destroying effects of sands when thrown by occasional disturbances upon the living barriers, for wherever these depositions lie, there the polypifers cease to build, until new generations spring from the sandy base, having no relationship in many instances to those who have gone before them however thin the coating of sand may be, a sufficient cause exists as in the case of the Great Chagos Bank, Speakers Bank and numerous others, for the appearance of dead rock in quantities more or less

That tidal action as well as accidental disturbances has much to do with the form of reefs is manifest in the numerous openings of reefs, and in their geographical distribution the fringing reefs encircling the Mauritius have a straight passage open in front of every river and streamlet running into the ocean and at Great Port there is a channel like that within the barrier reef extending parallel to the shore, each end being entered by a river, the two streams bending towards each other The Australian barrier extending nearly 1000 miles bending to the sinuosities of the coast would appear to have its basis on a submarine mountain range on either side, its boundary of growth from the bottom appears to be defined by sands it has few openings sufficiently large for vessels to pass through and from its general dispositions it has the appearance of being one vast submarine mountain chain varying in its composition beneath but capped throughout with coral reefs the polypifers being unable to extend their breadth in consequence of tidal action and shifting sand throughout this vast range there is no evidence of extensive dislocation such as might be expected had it been elevated by volcanic action but its sinuosities and general character give it a striking similitude to many of the calcareous formations on the mainland all of which bear evidence of the recession above the present sea tidal action is also manifest in the fringing reefs of Eastern Africa and in fact all other places where these formations abound

The coral formation appearing above the waters is violently attacked by the element which gave it birth and before the repeated attacks of tempests it falls piecemeal and the upper portion being washed away, it once more becomes a sunken reef, and the polypifers may be once more observed busily building up the edifice again, from the effects of currents many islets are washed away as is recorded of the Maldives and as I have repeatedly observed in the Red Sea but this destruction is far from being general, for the increase of coral reefs, coral banks, and calcareous beds, in adding to the earth is infinitely beyond the decrease occasioned by the destroying powers of flood or fire, and every island and every barrier reef standing above the waters from its unbroken appearance and the simplicity of its material demonstrates the vast increase the earth constantly receives principally from the labour of these minute forms of life

Of the largest lakes di... coral groups such as the Atoll Sundiva which is 44 miles in length and 34 in breadth and encloses a great expanse of water from 2[0]0 to [3]00 feet deep other and more extensive views may be taken of their mode of formation such as the peculiar form of their submarine bases the effects of the currents, and of depositions and when above the surface the effects of storm It is observed as a peculiarity and exception to the general rule that many of them have a greater number of openings on the leeward than on the windward side thus on the inner sides of Ari, and the two Nillandoo atolls which face S Male Phaleeloo and Mologue Atolls, there are 73 deep water channels, and only 25 on their outer sides this difference is attributable to the action taking place while the reef was far beneath the surface of the waters the more numerous lodgments of sands, marl, &c inimical to polypus life being deposited on the extreme edge of the reef in the tidal line which occasioned more numerous separations or openings on the less exposed side of the reef

From whence then are derived the vast quantities of calx requisite to supply the building of these enormous formations constituting mountain groups and chains and filling the ocean valleys and the valleys of all seas with calcareous beds many hundred feet in thickness and many thousand miles in area constituting also, so great a portion of the surface of terrestrial earth? Dr Buckland says It is difficult to account for the source of the enormous masses of carbonate of lime that compose nearly one eighth part of the superficial crust of the globe but until it can be shown that these animals have the power of forming lime from the elements, we must suppose that they have been derived from the sea either directly or through the medium of its plants, this is a very unphilosophical way of disposing of the question for, admitting that it cannot be proved that the lime is elaborated within the living body we can still demonstrate that it cannot be derived from springs or through the medium of plants the quantity of lime held in suspension by the ocean waters is very trifling and is nothing compared to the chlorides of sodium and magnesia—and to furnish these three salts in the quantities required the whole interior of the globe would be insufficient again was it derived from springs what an enormous supply would be required to fill up the bed of the Mediterranean alone, which, according to Donati is 900 feet in thickness in calcareous matter again, fuci are not to be found in the lowest depths, they follow animal species in the order of developement, and abound principally in those regions where coral formations are wholly unknown they do not secrete lime, although in the shallows they sometimes become coated with this material by polypifers.

The small portion of lime held in suspension by the waters of different seas

and c h c he l l l v l s of chl ride of s hum increa g were milt t cr Wl re h ir ue most d ul i t t itu ally give c c therc u s v th l tedl wi him he livin system the bi e co r l inte c nnm it is true that chemistry sheds ro high up l c j c h earths being c s c l s unde compounded bodies widely c r m l tur fr m each th r but observation and experiment alone c h t the earth undergoes many modifications, and, as in- stanced n l p rmnment changes but mitting negative to this supposition h s ll to l s for its element s constituents in the living body M l l g s that it is suppl l v thermal springs but if so why n h ver regions wholly destitute t him secreting species by w l p luced and deprived t the requisite degree of warmth mo h p cs p h um the genera orders and species multiply ra pidl n l h llows and the u tit c c k reous matter increase faster and ne ns is there th n n the deeper v ters numeron species of the m re l ue co thnes existing e s where the reflecting r l radiating heat g m the v t shallo s whos v lleys are covered with ml c n m l th mere c c l ence t matter stillm re rapid and extr e r rv th n vith n the comb e l the law of formation and secretion bein h l he t m l c l circumstances or more properly sp l v r c t n produced by the conjoint operations of light heat, and lit n tl t they do no d ive their lim from th l e on which they rest c n l l v th c nt m us r cess of the s calcareous base, as it derive c s n c l matter from t he liv ng n l he de d thus, the entire beds of n l seas are rapidly fillin p l v the filling up of the ocean mde n over t c r tens

to h ho ask the q tion When e come c lcium t would say when the perhaps equally enormous quantity of innumerable gel t c l n l there p d manife m organic forms being in q ntt s c st tuent f the nmal r l vegetable forms work each of which m n v l l form mountains and probably r untain chains Whence come the m e l l nl lit m ns of Asi Peru America and England Where l t form the c l emical ed mechanic l operation of life is is testified by h s s l t m r ot th earth and l v the changes that are continuall t l l c e cen cur eves In the fossil we identify the once living, l ly c ul r specie m l con equently n peculiar habit and charac c r v l cive that its c ly stem l t d in combination only, but its relation n n h ve l ecome c nvert l nto thei earth again, the tree c t lnto c l and the n mal l l nding the with is l o c nverted in c l n the fossils substituted n l nt m like manner is the madre pore l l petrescen l date and l l converted int rocl The m lytic l l whom all m n n l l t l many of the most inper ion s c pl t t ry of the m t c l properties f bodie and of the r t t v constituents tell ve that however numerous the phe- nomen t l l t l s h wever compl cated them m there n s structur h v den c on s l th them materi l n l of th res luble m t th t unkn n compoun ds hydro en oxygen, nitrogen and arbon all l h m mechanical mixtures f the c ter l l ri nt Why then should it l n e n t r c f surprize that the living principle which is univer l p nt and meets these num rous con nation, sh ld be the im v l l b r t r c nm vith n the liv v t r Animals of even th r nim m el borate c nmonic wh ch the disting ish- ing ch t r s c l muml l l anim l cl l r l dominion celating and calcium n l v gctables absorb the latter giving it f r and sensoridum n n d transmit it in this state to the fo s and mine l l n lom, the c nd the h of the undecompounded bodies ro mechanical mixtures in ma them r c ex t tude of primary element r t of these united with secondary qualities A m tted that many terrestri l animals abstract the p rtion of pine th v n un from the earth still his r manifest proof that such is the c nr l t s t nature the complex organization of the higher orders of n m l s produced by ab tr ction of some compounds from other bodies, n l by l c bination of others by the mechanical and chemical union of these abstr c l c mpoun s within the living system thus bile red blood fibrin and other humour products are generated

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Proposed Docks on the Cheshire Side of the Mersey.—The leading topic of conversation in Liverpool has been the avowed project of the commissioners of Birkenhead to construct a dock on the Cheshire side of the Mersey. It seems that the intention is not a new one but has been cherished a con l e time, and the parties only waited until the corporation of Liverpool had disposed of their land there, or a portion of it, for other purposes pr n t announcing it to the world. The consent of the Admiralty h e n obtained for enclosing the whole of Wallasey Pool, from the bottom of the Wood c l ferry to Seacombe—an area of not less than 10 acres. It w nded to h e gates, a tidal basin of 30 acres 12 feet of water at all times of tide for vessels to float in and dock space to the extent of 120 acres also an additional tunnel under the township to connect the tunnel extending from the station of the Birkenhead and Chester Railway, at Grange-lane, to the Monks Ferry, with the dock. The cost of the work was estimated at near 300,000*l*. All the pecuniary advantages derived from the dock are to be appropriated to the measure itself, and if ever, from the sale of part of the land, or otherwise, any other revenue should arise, it is to go in the reduction, first of all of the dock rates, and afterwards of the cost of construction, until finally the dock should be open to the whole world free of charge. Plans had been prepared sections taken, bearings made, levels obtained, notices ready, and everything in a state of forwardness.

Westminster-bridge.—Since the carriage-way of this bridge was closed, the workmen have been engaged in removing the great body of loose sand and rubble walls which loaded the east pier of the centre arch unnecessarily, and are preparing to substitute brick arches, &c., for this, as described in Mr Walker's letter to us, and as was done to the sunken pier on the Middlesex side. Mr Nixon, the superintendent of the works, informs us that the lessening of the weight upon each pier by this operation and by the proposed lowering of the roadway, will not be less than 1,700 tons, and that since this lightening began there has not been the smallest movement in any part, whether, however, this will continue so, time only can prove. Messrs. Walker and Burges have thought it prudent to take the opinion of two other eminent engineers, Messrs Cubitt and Rendel, we understand their opinion also to be, that the sinking of the piers of the bridge is caused by the great load upon the clay foundation, their being no piles under this bridge, and the ground on the Surrey side being of a loose n ture. Supposing this to be correct, to lessen the load appears the direct remedy. The masonry of three of the arches being laid bare gives an opportunity for taking out any sunken stones, and stopping the cracks from the upper side and is now in progress. Many of our readers may not be aware, that when Westminster-bridge was begun the intention was to have wooden arches, and that the thickness of the piers was enlarged for carrying stone arches without adding to the foundation. Hence perhaps their general weakness. It appears from the plans which we have seen, that there is a thickness varying from 2 feet to 7 feet of sand and gravel between the bottom of the caissons and the clay.—*Times*.

THE NEW AMERICAN STEAMER 'PRINCETON,' AND THE 'GREAT WESTERN.'

It appears that Brother Jonathan is in ecstacies, because he has produced a rival vessel to the Great Western, and beaten her in a trial, when the latter vessel was leaving New York at her last trip to England. The only information we can collect is from the newspapers, the first announcement appearing in the *Times*.—

A trial of speed between the Great Western and the American steamer of war Princeton is very minutely described in the United States papers. The result was a decided victory by the Princeton though it is said the Great Western sailed faster than on any former occasion. The Americans, as might be supposed have not lost so excellent an opportunity of displaying their talent for boasting, and speak of the victory in much the same terms as would have been used if they had conquered an important province. This eulogy of Captain Stockton of the Princeton, and under whose immediate direction the ship and machinery were constructed, appears in the official paper, the *Madisonian*.

Our friends across the Atlantic have forgotten to tell us that it was a "Britisher" who designed her engines and the propeller, both being the invention of Captain Ericsson formerly connected with the respectable firm of Messrs. Braithwaite and Co. of London, and patented by him in this country, the engines are of the vibratory principle (not oscillating). The following particulars we extract from a Liverpool paper.—

The Princeton is propelled by the Ericsson propeller—her tonnage is about 680 and the engines equal to the power of 250 horses the diameter of the single propeller, which works amidships 14 feet. The rudder is hung on a metal rudder-post re ting to a prolongation of the keel under and beyond the propeller and of course beyond the hull of the vessel. Above the propeller the cabin of light basket work projects and through it the rudder comes up. The Great Western is double the tonnage of the Princeton and her engines are equal to the power of 420 horses. She draws four feet less water than the Princeton arising probably from the great diameter of the propeller, and the necessity of its being submerged. The propeller makes 36 revolutions in the minute the Great Western's wheels at the utmost 16.

From this comparison it appears that the Great Western ought (?) to have had the best of the race but Capt Hosken has affirmed, in extenuation, that his ship was l lep ' and that it was rather more so than usual ' and he further alleges that during the time the Princeton was sailing with the Great Western the latter was goin at the rate of 9' knots an hour conveying apparently an idea that she was not going at her usual speed, whereas we have the testimony of I B O den Esq., of this town (Liverpool) an authority of indisputable veracity (who was present on board one of the vessels at the time, and saw and noted everything specifically) that ' the distance from where the chase began to Sandyhook is perfectly well known, and capable of being ascertained by any one,' and that ' by the course the Great Western took the distance was 18 miles while that taken by the Princeton was 21 the former performing the 18 miles in 1 h 28m and the latter the 21 miles in 1 h 31m against a strong flood tide and adverse currents." This, therefore, would give the Great Western twelve miles an hour and the Princeton fourteen, the difference being two miles an hour, instead of three quarters of a mile

THE WIER ACROSS THE SHANNON.

SIR—If your correspondent who furnished the article on the great Weir across the Shannon, in the October number of your *Journal*, would favour the public with a few more particulars of that work, I think it would be highly interesting to your readers, especially as he appears to make an assertion which in its present form I cannot admit to be true, viz., "that a bar or weir may be constructed across a river in such a manner as to give an increased discharge." At the same time I am aware that the channel of a river may be widened or deepened, so that, notwithstanding the impediment of a weir (of certain dimensions) an increased discharge may be obtained.

Supposing the Shannon at Killaloe to be in its former condition and flooded to the level of nine feet above the present level of the weir, I apprehend your correspondent does not mean to say that simply placing the impediment of a weir in a certain position would at once reduce the level of the water six feet. Under such circumstances there would not be any perpendicular fall over the weir, merely a slight rapid, the stream preserving its former direction, which being the case, the cross section must be taken in all places at right angles to the stream, to give the true sectional area of the river, which area would of course be reduced by the weir. If the weir were placed at right angles with the stream, and the river widened till the sectional area of the water passing over the weir was equal to the area of the river above, or if the weir were placed, as shown in the plan accompanying the communication, and the channel below deepened, so as to give a perpendicular fall over the weir, (in which case the area of discharge must be taken in the line of the weir,) then the advantages mentioned by your correspondent would be obtained but unless the channel is widened, or deepened so as to give a perpendicular fall over the weir, the discharge must be impeded by any obstruction opposed to the stream.

I remain, Sir, &c.,

[illegible]

ON CONTOURING OF MAPS.

SIR—In your Journal for this month I have read a description by Dr Livesay of an instrument invented by him in 1839, for copying medals, &c. and in which he speaks of my "important application" of the principle of contouring, which he thinks may be subsequent to his invention I only trespass on your pages to say, that if Dr Livesay attributes to me the application of contours to the representation of ground, he gives me a very undue merit They have been so applied for more than half a century, especially to military plans, where the relative command of ground is of great importance, for which purpose all officers of engineers are instructed in contouring. In France and Bavaria, and I believe in some of the States of America, they are used in the national surveys. In Ireland, Mr. Bald, the eminent civil engineer, contoured a part of his Map of [illegible] The application of accurate contouring to the representation of ground on the Ordnance survey of Ireland, commenced in 1838, under the direction of Lieut Bennet, R E , and the trials have proved that the system may be applied without incurring any such addition of cost as should preclude its general adoption, to which this question of expense had long been the only objection There are many valuable papers on contouring in the *Memorial du Depot de la Guerre* and a concise chapter on the subject in Williams' Practical Geodesy.

I have only to add that I had not heard of Dr. Livesay's instrument till I read the account in your Journal for the present month.

I am, Sir,

Your obedient servant,

Dublin, November 20, 1843. T. A. LARCOM, Capt. R. Engineers.

REMARKS ON SHIP'S FASTENINGS AND STEAM BOATS.

BY J[illegible], ESQ.

The necessity of great strength in the hulls of steam boats, has long been acknowledged, in consequence of the concentrated weight of the engine and boilers In recent instances, however, a portion of this [illegible]

engine, [illegible] subjected to a variety of cross strains, at the junction of different masses of cast iron, at which points unequal contraction in cooling is apt to produce weakness.

Engineers have been accustomed to guard against injury from the weakness of the ship, by placing the engine on the floors in a framing, as independent as possible of the hull of the vessel, and left the ship-builders to provide a remedy against the sagging, or sinking of the centre part of the hull

Though much has been done to strengthen steamers, yet enough remains undone, to render it a legitimate object of inquiry, whether the limit of strength has been reached in ship building, while the severe and rapidly increasing competition of iron vessels, renders it of importance to the builders of timber ships, to consider every practicable means of improvement and reduction of cost. Conceiving the iron strap used by miners in connecting together the main rods in shafts, and common in all framing designed by engineers, stronger than the ship-builder's knee fastening, a frame was submitted to the society for the midships section of a steamer, in which a strap was used for the purpose of connecting the deck beams to the side; this strap passes round one or more timbers, and is then bolted to the deck beams.

A similar method was shown for strapping an internal series of timbers to the floor heads and deck beams (forming two internal sides at the position of the bunkers) The arrangement of the coal boxes of large steamers on each side of the engine and boilers, would facilitate the adoption of a plan of this nature, without the loss of space exceeding one foot in the internal breadth of the vessel The plan of four sides in this portion of the vessel, could be adopted in iron vessels with the greatest ease, in consequence of the facility with which the fastenings could be effected

As regards the strength of the strap, it may be remarked that the straps connecting together the main rod employed in pumping water from deep shafts in the Cornish mines, have been known to bear the sudden repetition, for thirty million times, of a strain strain exceeding eighty tons (six strokes per minute average during ten years)

The difficulty of effecting repairs will be made an objection to the employment of the iron strap in shipbuilding. Important as such secondary objections are, yet they are too often brought forward as the prominent features, in opinions that are given against the success of proposed alterations in shipbuilding Time would alone prove whether the less tendency to require repair, where the iron strap is used, would equalize their average cost in repairs.—*Report of the Cornwall Polytechnic Institution.*

REMARKS ON FLOATING LIGHT VESSELS

BY J[illegible], ESQ.

The comfort of the light keepers on board floating light vessels will be increased, I apprehend, by the same means that would tend to produce greater safety in the vessel itself. It has been proposed to employ a larger vessel constructed of iron, to enable it to ride more easily at anchor and such would be the result, if the same breadth was allowed, from the lesser draught of water The form in which I am disposed to consider the subject is the relative proportion of the depth and breadth (outside measure), for the sake of comparison, of iron and the common system of timber vessels, and that of three series of planks fastening together Taking the least possible depth at 7½ or 8 feet, the breadth should not be less than 18 or 20 feet, and at 3 to 4 times the breadth for the length, from 60 to 80 feet long. The form of the [illegible] should be similar to that of a water fowl or of a light Dutchman The former, however, does not ride at anchor as the latter does in bad weather, and we should look for the [illegible].

The floating light vessels I have seen, resemble the Dutchman only in their heavy appearance, and seem constructed to resist as an oak, rather than to bend as a willow It is essential, I conceive, that a vessel suited for this purpose, should possess a large proportional surface department, in other words, that a light vessel should be lightly loaded. To enable her to rise with greater facility to the sea, she might be anchored by the keel by iron straps passing round it and one or more of the deck beams If the double plan was used, by changing the length of the chains more or less ease could be given to the bow in rising over waves Perhaps a keel deepening aft would prove advantageous in some positions, though perhaps objectionable in cross tides and seas, and sharp bows might be used under some conditions The species of knowledge required for mooring small craft in rough water, is seldom acquired by parties accustomed to large ships in the Atlantic or other open seas and an apprenticeship on board a Dutchman, or experiments on board a trial vessel with tanks, by means of which a variable displacement could be obtained, seems to offer the best means of procuring the data required for a complete solution of the question, of the best form for a floating light vessel.—*Ibid.*

ON THE MEANS OF PREVENTING THE APPEARANCE OF SALTPETRE ON WALLS.

Communication from C. H. Smith, Esq., in reply to Questions proposed to him by the Commissioners on the Fine Arts, respecting Causes of and Means of Preventing appearance of Saltpetre on Surface of Walls.

The mineral substances chiefly used in building, consist of lime, sand, and different kinds of stone, neither of which contain any saline or deliquescent matter as an integral part of their composition. No trace of salt or alkali is mentioned in the analyses of various stones that were examined with reference to the selection for building the New Houses of Parliament. Bricks are made of clay, which consists principally of alumina and silica, but generally containing some portion of lime, in the state of carbonate or sulphate, carbonate of magnesia, iron in the state of oxide, or combined with sulphur, and common culinary salt: these various materials, when exposed to a red heat, act chemically on each other, the magnesia most probably will combine with the sulphuric acid, which it obtains partly from the iron pyrites mixed with the clay, and partly from the fuel, if coal is used. It is this sulphate of magnesia (common Epsom salt) which is occasionally found to cover the surface of newly built walls with an efflorescence like hoar frost.

The presence of saline or deliquescent matter on the surface of a building either internally or externally, may, to a certain extent, be attributed to carelessness, ignorance, or inattention of those who superintend the construction of an edifice. Salts, alkalies, or acids, according to the usual acceptation of such terms, do not [illegible] form any part whatever of building materials. Nearly all animal and vegetable substances, when in a state of putrefaction or decay, produce a certain quantity of saline or alkaline matter which should [illegible] rapidly, therefore every precaution should be taken to avoid admitting such substances into a building where damp walls are likely to be of serious importance. It has long been a practice among builders to [illegible] all the flues in a building for this purpose earth [illegible] of excrement, frequently of many kinds, are procured from a cow shed, and mixed with a little mortar, to put a coating throughout the interior of the chimneys. Another objectionable practice is common during the time that the [illegible] building is progressing, and [illegible] until the finishing is nearly completed which that of allowing workmen to urinate indiscriminately against the angles and recesses of the interior of a new building: no part is more frequently selected than the fire places before the stoves are placed therein, and in an extensive building, where hundreds of workmen are employed during several years the quantity must be quite sufficient to saturate certain parts of the structure beyond all remedy. Both these causes undoubtedly increase the presence of salts, &c., on such parts of the interior of buildings as are elevated above the influence of the ground. To show that dung and urine have long been considered to yield saltpetre abundantly a proclamation of Charles I., in 16[illegible], ordered all persons to save the urine of their families, and as much as they could of that of their cattle, to supply saltpetre for the manufacture of gunpowder: and in 1627 the saltpetre men were authorized to take [illegible] as the ground of all dove houses, stables, [illegible] others places where cattle were kept. There are many other [illegible] by which salts are conveyed into or communicated to the walls of a building but those already mentioned appear to be the most copious and which may be considerably decreased.

Under ordinary circumstances it is scarcely possible to get rid of the various saline or deliquescent substances that have once been admitted into the walls of a building. The fixed alkalies potash and soda may probably be considered imperishable, no length of time can injure them, they may effloresce or more properly, they may crystallize on the surface of a wall, and totally or partially disappear again [illegible], as often as a change in temperature or of dryness or humidity takes place: these changes may be daily, or the salt may remain inactive during ages, and then once favourable cause a crop of crystals may be produced as flourishingly as if the wall had been recently erected. The only way to abate the evil is to brush off the crystals dry, whenever they appear in the most flourishing condition. If potash has been introduced into the wall, either from the putrefaction of animal or vegetable substances such as have been noticed, or from other sources, however thick the wall may be, it will make its way to the surface, and then absorbing [illegible] from the atmosphere which [illegible] 70 or 80 per cent of it, [illegible] is produced.

If we now examine the possibility of salts [illegible] following state getting to the interior of a dry wall beyond the influence [illegible] of considerable variation of temperature in such case they would unquestionably remain crystallized as they were deposited, but such a state of things is never likely to take place: salts are generally communicated to a building in weak solution, the water very gradually evaporates, moving with it from the interior the salt, the molecules which compose [illegible] solution having arrived at the surface, so as to be freely in contact with the atmosphere (which is always essential to crystallization), [illegible] continues until the solution [illegible] sufficiently strong to crystallize, leaving only the mother water in the wall, which [illegible] indicated by certain damp [illegible]

Lime, in [illegible] some other sort of [illegible] earth, seems to act as a unifying principle [illegible] the molecules of salt and water [illegible], if no lime were present, crystallization would certainly be much less active. An increase of temperature or a humid atmosphere will slowly dissolve the salts; if both these causes occur at the same time, liquefaction will be rapid, and the newly formed [illegible] will be absorbed into the wall as fast as the salts are dissolved. These changes will take place with every variation of atmosphere: a cool dry air, in a state of absolute rest or stagnation, is favourable to crystallization; a warm one, charged with aqueous vapour, will facilitate solution. It is extremely probable that several kinds of salts may be formed on the same wall with their crystals intermixed so as to escape the discrimination of a casual observer, and that each will crystallize and liquefy at different times, according to the temperature and the quantity of moisture in the atmosphere: should this be the case, perhaps the wall may never appear perfectly free from efflorescence, so long as the various stimulants of air, moisture, light, heat, and other causes of attraction are in activity; and, since all attraction is mutual it may readily be understood, that as the particles of water attract those of the alkaline salt, and retain them in solution, so the particles of alkaline salt will attract those of the water, and hold them in crystallization.

It is difficult to state with precision the relative power of different bodies to attract moisture from the atmosphere; that such power exists independently of temperature is scarcely probable, as thermal influence appears generally diffused over the face of nature. Some substances are more susceptible of sudden changes of temperature than others, and thereby may occasion a rapid precipitation of vapour from the aerial or invisible state in which it exists in a warm atmosphere, to the fluid form on the surface of cold bodies; this circumstance arises solely from the solid mass of the wall requiring a much longer time to attain the same elevated temperature as the atmosphere. Bodies in contact with each other in due time arrive at one common temperature, by the hotter communicating the requisite proportion of the excess of its heat to the colder; the velocity of this communication varies in different bodies, some being quickly heated and as quickly cooled, others undergoing these changes much more slowly. It is probable that the atoms or completely solid parts of all simple substances have exactly the same capacities for heat, and that the perfect or imperfect conducting power of substances will be proportioned to their porosity, sponginess or the quantity of vacant space contained in their interstices. Dense bodies are generally the best conductors of heat, those which are the most porous conduct it very imperfectly; the metals, which are substances of the greatest density, transmit heat most rapidly; stones and earthy substances conduct it more slowly, wood is a bad conductor, and the natural clothing of animals—fur, hair, feathers, &c., are inferior to every other material in their power of communicating heat. These remarks are applicable only to the conducting power of solid substances; liquids are all very bad conductors of heat; therefore, independently of evaporation, a cold damp wall will continue at a low temperature much longer than a cold dry one, and hence it will influence the condensation of vapours during a greater length of time than if it were dry.

Various circumstances seem to infer the probability that voltaic electricity, considered as a chemical agent, may act some part in conveying moisture from the atmosphere to the walls of a building. All substances naturally possess electrical energies which are inherent in them, probably there may not be two substances, or even two distinct surfaces of the same substance that are not in different electrical relations to each other, and it is a law of electricity that bodies in opposite states attract each other. Lime, sand, bricks, and hair materials with which walls are usually constructed and plastered, are all when dry, bad conductors; whereas water is a good conductor of electricity, and whenever the atmosphere or water, or any part of the surface of a body gains accumulated electricity of a different kind from the contiguous substances, there is an immediate tendency to bring the parts in contact. In this manner other circumstances being favourable, floating aqueous vapours may perhaps be imparted to a wall, and absorbed into it by capillary attraction.

Electric influence, as connected with the preceding inquiry is merely offered as a hint with the view of inducing scientific men to investigate the subject. Hitherto the public are not in possession of any facts which have immediate reference to this important object.

C. H. SMITH.

[illegible], Clipstone Street, June 2, 1843.

OPEN SEATS IN CHURCHES.

So great is the present demand for good models of open seats, consequent upon the strong and fast-spreading dislike and condemnation of pews, and so numerous are the applications made to us for advice and assistance in restoring to churches their more Catholic arrangement for the accommodation of worshippers, that we propose to offer a few remarks on the proper proportions of this kind of seats, and the best method of fixing and disposing them.

The standards or ends of ancient open seats are generally distributable under three heads: (1) those which are sloped off with a shoulder and terminate in a boldly carved finial. (2) those that have an *elbow*, generally (as at Chesterton and Histon churches,) wrought into the device of a cumbent lion, dog or griffin but sometimes (as at Ketton, Rutlandshire) having a plain curvature; (3) those which are simply square or parallelogrammic panels. The last are usually the latest in date, though it may be observed in general of open seats, that they scarcely ever bear the marks of great antiquity. Whether any are to be found as early as the fourteenth century we do not know; but there is every reason to believe that, till the conclusion of the Edwardian period, the area of churches was quite free and unincumbered, and that if

seats were used at all, they were moveable, and only placed in the Nave on occasion of service The square panels are peculiarly common in Somersetshire, where they are carved in the richest and most varied devices, as may be seen in a valuable series of sixty seven drawings of them recently presented to the Society

The average height of the standards in ancient examples measuring from the ground to the top of the finial, is from three to four feet, by from fifteen to eighteen inches wide. Those, however, described under the third head are usually from eighteen to twenty four inches wide In this case, the back is of the same height as the ends, in the others, the finial and shoulder project above the back, the capping of which is usually about two-and a half feet above the floor The standards are of oak, seldom much less than three inches thick and they are fixed by having the lower ends mortised into a *cill* or sleeper of oak four or five inches square The distance apart in the clear, that is, measuring from back to back, is usually three and a half feet Two and a half feet is the very smallest distance that can be allowed The seats should be not less than fourteen inches wide and raised above the floor or pavement sixteen inches These will be found the most comfortable as well as convenient proportions

It is a great mistake to make the backs high or sloping In the former case the support is against the shoulders whereas it is required in the middle of the spine In the latter a *loll up* or *easy chair* position is induced, and the worshipper who kneels behind it is greatly incommoded by the projection of the upper part It is moreover necessary that the seats be placed further apart when they have inclined than when straight backs A kneeling board should be placed at the back of each, so as to face the worshipper in the seat immediately behind and serve as a desk for books It is usually about seven inches wide, and raised one foot and a half above the floor In some ancient seats this is placed only a few inches high, apparently for the worshipper to kneel *upon*, while the other is to kneel *at* Very rarely both occur together

Modern bench ends almost invariably labour under the following defects (1) They are much too high We have known them not less than six feet in height to the top of the finial and they are seldom less than five (2) They are usually of stained or painted deal (3) They are put together with iron-work instead of wooden pegs (4) They are not sufficiently substantial (5) They either have block poppy heads, or are carved of the most incorrect and scanty detail (6) They are fixed to the flooring and not pinned to cills (7) They are generally of some ludicrous and fanciful design We have seen *Norman* designs for bench ends, having semicircular tops, and panelled with semicircular arches with Norman capitals and shafts Early-English open seats are equally absurd, since, as we have said, in the twelfth and thirteenth century the thing itself was utterly unknown

We are very glad to find that the Oxford Architectural Society have just published some excellent lithographic prints of the open seats (in perspective, elevation and section) in Steeple Aston and Haseley churches, Oxfordshire These sheets will prove a valuable contribution to the cause which we advocate in common, and are of themselves a sufficient guide to those who are desirous of following approved examples

It should ever be borne in mind that open seats are *actually cheaper than pews*, since this is an argument in their favour which is likely to have no little weight The cost of a well carved ordinary standard in oak, including the material, is about 30*s*. The finials *may* be worked separately, at about 10*s* a-piece, and afterwards attached at the collar to the standards. Either may be executed to order by our wood-carver, Mr Groom (62, Sidney Street, Cambridge), from a series of very excellent models from churches in the neighbourhood, casts of which are sold by him at 2*s* each. We do not however recommend the latter expedient for general adoption A far better way is not to have all the poppy heads carved at once, but to work the block terminations gradually after the standards have been fixed in their proper position Detached poppy-heads should always be well executed in oak, and if they are at first fastened to deal standards, these can be afterwards removed one by one, and such oak substituted in their places A set of well-carved oaken standards is a peculiarly appropriate gift to a church

We will suppose now that it is resolved to clear away from the area of an old church, the motley assemblage of *pews*,— painted, baize-covered, short, tall, square, oblong, flimsy deal or panelled oak, or whatever hideous variety they may present —and to restore the ancient arrangement of uniform open sittings throughout These, of course, will all face the east, and a central passage will be left down the Nave, and another parallel to it on each side next to the piers in the Aisles, so as to leave the bases perfectly free and unencumbered Now, what is the best method of procedure after this happy consummation has arrived? First then we recommend the entire flooring (which is sure to be in a bad state from the vaults and encroachment of the pews) to be taken up and a bed of concrete a foot in thickness to be laid uniformly over the whole of the interior area In this a pavement of encaustic tiles, or at least of squared stone slabs must be firmly fixed When this is done, and the mutilated bases and piers restored, some idea will be conveyed of the ancient appearance of our parish churches Thus the ground will not easily be opened for graves, and the floor will be kept clean dry and wholesome, provided, of course that proper attention be paid to the external drainage and clearance of the soil from the earth line Upon this pavement cills or sleepers of oak should then be laid *loose* in a direction from east to west, and to these the standards should be mortised at such intervals that the backs may be, at the very least, 2 ft 6 in apart in the clear If a boarded floor be insisted upon,— as it often will be, from an ignorance of what a dry and level pavement beneath the feet really is,—stout planks may be laid over and upon the pavement *from* cill to cill, into which they may be made to fit by a groove, in such a manner that they can at any time be readily removed for the purpose of cleaning and thoroughly drying the floor underneath. Thus also, if the occupants of one seat consent to try the withdrawal of the board and find no inconvenience therefrom, others will certainly follow the example, and the plan which we have ever recommended, namely, to have a stone or tiled floor under the seats is far preferable to boarding, will be gradually achieved We can assure our readers that we have seen many ancient churches in which no boarding has ever been placed under the open seats, and the appearance is much better, and the comfort to the worshipper certainly not less, for the absence of it

Name of Place	Apart	Total Height of Standards	Width of Standards	Width of Seat	Height of Seat	Height of Back.	Height of Kneeling Board	Width of ditto
	ft in	ft in	ft in	ft. in	ft in	ft in	ft in	in
Ketton, Rutland	3 7 } 2 11 }	4 0	1 6	1 3	1 3	2 9	1 9	8
Boston, Lincolnshire	2 6	2 7½	1 3	10-11 in	1 4	2 6		6
Chesterton	3 0 } 3 6 }	3 3	1 5	11 12 13 in	1 4	2 4	1 6 7	7
Impington	2 8	3 6	1 6½	1 0	1 4	2 3	0 9	
Histon	3 6 } 3 2 }	3 2	1 4 5	12 14 in	1 6	2 5		
Fletton Huntingdon	3 7	3 6	1 2	0 11	1 5	2 6	1 6	9
Stanground, Huntingdon	3 6	3 7	1 2	0 11	1 4	2 7		
Broomfield, Somerset	2 10	2 9	1 4	1 0	1 6½	3 1½	0 6	5½
Bishop's Lyd, Somerset	2 6—2 8	2 7	1 4	0 11	1 5	3 0½	0 8	8
Cothelstone, Somerset	2 11	2 9	1 4	1 0	1 3½	2 10	0 9	7
Bagborough, Somerset	2 3½	2 10	1 4	0 11½	1 8	3 1	0 10	5½
Fulbourn	2 4	3 10	1 2½	0 11	1 5	2 7	1 9	4½
Landbeach	3 9 } 3 2 }	3 2	2 1	1 0	1 4 } 1 6 }	3 2	1 10	9½
Comberton	4 0 } 3 10 } 3 8 }	3 3	2 0	1 1	1 4 } 1 9 }	3 3	1 6 } 1 10 }	7
Toft	4 0 } 3 6 }	3 5	1 7	1 1 2	1 [illegible] } 1 6 }	2 4 6	1 7	7
Harlton	3 4 } 3 6 7 }	2 6½ } 3 0 }	1 9 } 2 0 }	0 10 } 1 0 }	1 4 } 1 7 }	3 4 } 3 6-7 }	1 7 } 2 0 }	7

We add some measurements of ancient seats, taken from several counties, which will probably be serviceable to many of our readers. We would call attention to the remarkable uniformity of proportion which generally characterises those of the same kind. Indeed it would be useless to multiply examples to a great extent, since any important difference from the above measurements must be regarded as an exception. In conclusion, we would urge all who are about to replace open seats in their churches to follow faithfully *ancient examples*, which are happily even yet sufficiently abundant in our parish churches.—*Ecclesiologist.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

June 13.—The President in the Chair.

"*Description of a Plan, adopted for carrying off an accumulation of Water from the Warehouses, Cellars, &c. near the Wet Dock at the Port of Ipswich.*" By George Hurwood, Assoc. Inst. C. E.

This paper states that in consequence of the formation of the wet dock at Ipswich, the water from the land springs which was formerly carried away by the river, accumulated to such an extent, as to cause serious inconvenience to the owners of the warehouses, cellars, &c., many of them being beneath the level of the ordinary tides. It was difficult to find a remedy for this, as nearly the whole of the line, affected by the water, was at so low a level, that a discharge could only be effected at the lowest ebb of the tide, and a general sewer could not have been constructed at a moderate expense, because from the lowness of the level, water would have accumulated constantly in it, and any casual increase from rain or other causes, would have been sufficient to inundate the adjoining buildings.

The plan designed by the author, and which has been executed, had for its object the construction of a sewer which should drain these buildings alone, and at the ebb tide should carry off the accumulated water, being at the same time of sufficient size to contain the water, which was prevented from being discharged by the flowing tide. It was required therefore to be water-tight, and branch drains were necessary from all the points where water penetrated.

To insure the success of the plan, every precaution was taken for preventing the influence of the tide in the general sewer, retarding the discharge or operating upon the lateral sewers.

At the end of the main sewer was placed a cast iron frame, upon which were hung three tide flaps with brass facings, accurately fitted, and balanced by levers and counterweights. By this means the water was discharged at any height, and without any considerable head of water being required to open the flaps. Each cellar was connected with the main drain by an iron pipe, with a well balanced valve at its end, so that the water could have an easy exit, but as soon as any accumulation within the sewer occurred, the valves closed.

The sewers were built of brick, in mortar made from blue lias lime. The dimensions varied from 12 inches to 21 inches in diameter, and the cost of the latter size was 12s. 9d. per yard, including excavating, laying, filling, &c.

The plan is stated to have proved very successful, and as particular regulations are enforced, to prevent any admission to the sewers of other than the water which filter through the natural strata of the chalk basin, the water in the sewers is fit for domestic or manufacturing purposes.

The communication is illustrated by a drawing showing the situation of the town and dock of Ipswich, with the extent of the lines of sewers, and the details of their construction, and that of the tide and other flaps.

"*On the Formation of Embankments for Reservoirs to retain Water.*" By Robert Thom, M. Inst. C. E.

After describing a model, designed to show that the proper slope for reservoir embankments, should not be less than three to one on the water face, and remarking that waves act more severely on the pitching or paving of the inner face, in proportion to the steepness of the slope, the author proceeds to describe in detail the mode of forming embankments. The foundation is excavated to such a depth as is found firm and capable of preventing the passage of water, then spreading alternate layers of puddled peat, or alluvial earth and gravel, and beating them together with wooden dumpers until they are completely mixed, the slopes are covered with a puddle made with small stones or furnace cinders mixed with clay, so as to prevent the possibility of moles or other vermin penetrating into the embankment. He condemns the practice of forming embankments with puddle-trenches, and refers to many reservoirs made by him at Greenock, Paisley, and elsewhere, the banks of which have stood the test of time without having any puddle trenches in them, and particularly mentions one at Greenock which remained firm and sound, after a rush of water passing over it at a height of ten feet, caused by the breaking down of the embankment of a reservoir situated about 100 yards above it. He recommends, instead of the puddle-trenches, that the whole of the inner part of the embankment should be made water-tight during the formation of it, by which means it will more effectually resist either any casual injury, or any effect of the swelling of the puddle trench. The paper is entirely of a practical nature, and is intended to illustrate the author's peculiar views founded on his long experience. It is accompanied by a diagram of the model used in his experiments.

June 20.—The President in the Chair.

A Pressure Gauge was presented for the Museum of the Institution by Alfred King, M. Inst. C. E.

This gauge, which has been used at the Liverpool gas works for more than ten years for indicating small amounts of pressure, consists of a close cistern containing water, in which is a cylinder having in it a hollow float, connected with a balance weight, by a fine silken cord, passing over a pulley, on the axis of which is fastened a pointer, one end of which marks the amount of pressure upon a dial divided in such a manner, that its each division is equal to a column of water of $\frac{1}{10}$th of an inch, a difference equal to $\frac{1}{40}$th, or even $\frac{1}{100}$th of an inch, may be estimated.

The action is very simple, the float being elevated by the rising of the water within the cylinder, when the surface is depressed in the cistern by the pressure of the current of gas from the inlet pipe.

The description was illustrated by a diagram showing the internal construction of the gauge.

"*Description of a Machine for raising and lowering Miners.*" By John Taylor, M. Inst. C. E.

The author states that the great depth to which the copper and tin mines, in Cornwall, and in Germany had been worked, had drawn simultaneously in the two countries, the attention of engineers to some mode of facilitating the ascent and descent of the miners, whose strength was exhausted, and their health seriously affected, by the fatigue of going to and returning from the scene of their labours by nearly vertical ladders, as the men could not be raised and lowered by the rope of the winding engines, as in the coal districts. The Polytechnic Society of Cornwall offered premiums for machines for effecting this object, and in 1834 three prizes were respectively awarded to Mr. Michael Loam, Capt. W. Nicholas, and Capt. W. Richards for plans, the two first of which embraced the principle which has since been adopted with modifications, both in Germany and in Cornwall. A premium was also offered by Mr. Tremayne for any new method, or for the most available improvement on the former plans, and was awarded in 1838 to Mr. John Phillips for a method, differing, however, from that which has been put in practice. About this time it was ascertained that a machine, somewhat similar to that designed by Mr. Michael Loam, had been applied with success to one of the deepest mines in the Hartz, and drawings, with a description, were published in the Report of the Polytechnic Society of 1838. Mr. Charles Fox also commenced a subscription, for the purpose of awarding a sum of money to any proprietor of mines, who would first bring into active operation, efficient machinery adapted for the purpose in question.

At length the adventurers of the Tresavean copper mines, undertook to erect a machine from the designs, and under the superintendence of Mr. Michael Loam. It was first used for a depth of 27 fathoms, on the 5th of January, 1842, has since been extended to 264 fathoms, and it is now contemplated to carry it to the lowest part of the mines, which is 288 fathoms deep.

The machine, which is worked by a steam-engine, with a cylinder of 36 inches diameter, consists of two rods, to which are attached, at intervals of 6 feet throughout their length, platforms upon which the men stand; these rods receive an alternating motion from two cranks, which give them a stroke of 12 feet, the men, either in ascending or descending, step from one platform to the other, as the rods remain for an instant almost stationary, when the cranks are going over top and bottom centres, and as the platforms are half the length of the stroke apart, one set of men can ascend while another set is descending, without at all interfering with each other. Each rod makes three strokes per minute, and when once the platforms are filled with men, they are landed at the rate of six men per minute, either going up or down, the speed of travelling being about 72 feet per minute, or 240 fathoms in 20 minutes. By the ordinary mode of ascending by ladders it would have occupied 48 minutes to mount from the same depth, as the usual speed is about 30 feet per minute, so that more than 50 per cent. of time is saved, independent of the diminution of fatigue.

The rods at the Tresavean mine act vertically for the first 70 fathoms, below which they follow the direction of the vein, diverging from the perpendicular from 6 inches to 18 inches in 6 feet. The action of the apparatus is stated to be perfectly successful, no accident has occurred in the use of it, and the miners are convinced of the safety as well as the ease afforded by it.

The paper is illustrated by two drawings by G. B. W. Jackson, Grad. Inst. C. E., showing the details of the machine; they are copied by permission of Sir Henry De la Beche, from the model now in the Museum of Economic Geology.

Remarks.—Mr. Taylor observed, that there was an extraordinary coincidence of time in the appearance of this invention, as the public attention,

both in Germany and in England, seemed to have been directed to the subject simultaneously, without any correspondence between the engineers o the two countries. There had been many competitors for the premiums offered in Cornwall for the best method, but the only successful plans were those mentioned in the paper; and the machine therein described was a combination of the plan proposed by Mr. Loam and that actually in use in the Hartz mines.

Mr. Buddle recollected many years ago seeing a model of a somewhat similar machine, which had been in use in Germany for fifty years: it consisted of two rods, upon whose sides were hooks, at given distances, which on receiving a reciprocating motion were alternately engaged on the opposite handles of the "kibble" containing the ore, which was thus raised to the surface; it was probable that the idea of raising the miners had been taken from this old machine.

Mr. Taylor replied that he did not think Mr. Loam knew of the existence of any machine of the kind, and that the first impulse given to the subject was by the premiums offered for the best method, which had directed the attention of engineers to it. An American machine somewhat similar to that described by Mr. Buddle had been exhibited in London by Mr. Slade; it was designed for raising ore and water, but Mr. Taylor thought it applicable to raising the miners, and directed the attention of the patentee to the subject, but the machine was not successful.

In answer to a question from the President, Mr. Buddle said that the system was not applicable to the mines at Newcastle, as the men went up and down by the rope. By the use of guides and slides, the rate of drawing the coal to the surface was generally about 18 feet per second, which was not, however, considered sufficient, and a greater velocity was contemplated.

"*Description of Annular Valves used for Pumps for Water-works, &c.*" By Richard Hosking.

The annular valve consists of three concentric rings, arranged pyramidally, and resting one upon the other, thereby affording a free passage for the water around the circumference; the upper ring is attached to a stalk, and the two lower ones have internal wings, which serve as guides when the rings are in motion.

The chief advantages afforded by these valves are stated to be an increase of water-way and a reduction of concussion, for as the concussion occasioned by the shutting of pump-valves is in proportion to the surface in contact, and the square of the height or distance passed through while in the act of shutting, the greater the number of parts of which the valve is composed, the greater will be the freedom of water-way, and consequently the burthen on the engine and the concussion will be proportionally diminished.

These valves were first used in two 30-inch pumps at the Waldersea Drainage, near Wisbeach, and they have since been introduced into the Royal Polborro Consols Mine and the Vauxhall Water-works.

The description is illustrated by a drawing, showing the construction of the internal parts.

"*On the construction of Valves used in Pumps for raising Water.*" By Samuel Collett Homersham, Assoc. Inst. C. E.

The author first describes the original leather flap valves which are in common use, shows their defects, the modifications which have been introduced in them, and the reasons why a better kind of valve was necessary, particularly for large pumps appended to steam engines, quoting from Mr. Wicksteed's work on the Cornish engine,[1] that by the closing of the valves at the East London Water-works, the whole of the engine-house was shaken. This led to the application, by Messrs. Harvey and West, of a modification of the double-beat steam valve,[2] only making it self-acting; by this, it is stated, the concussion is so much reduced that little inconvenience is felt from it. No air is required to be admitted beneath, as is frequently the case with common valves, consequently the pump when at work lifts its full complement of water.

The author states that in this valve the diameter of the top seating is somewhat smaller than the lower, for the purpose of allowing a sufficient area for the pressure of the water to act against in lifting it. He remarks that the pressure required to open these valves appears to vary from 2 lb. to 5 lb. per square inch, and that it does not seem to follow any uniform rule. The seatings which answer best are composed of pieces of wood fitted in a groove with the fibres in a vertical position. The principal advantages of this kind of valve, as to durability, slight concussion on closing, facility of repair, &c., are then enumerated; but it is urged against them that the passage for the water is circuitous, and therefore the power required to force the water through, is considerable, and that in a large valve the height to which it rises is too great.

He then states that Mr. James Simpson, who has had great experience in the difficulties attendant upon the use of large pumps, some years since conceived the idea of obtaining valve openings nearly equal to the full area of the clack chambers, by means of a conical valve formed of rings shutting down upon each other; this was afterwards modified into a valve with separate seatings for the rings to fall upon, allowing a passage for the water both inside and outside the rings, thus obviating the necessity of their lifting more than one-half the space of the width of the openings in the seating, and it was found that in valves of large diameter, by increasing the number of openings, the height of lifting in opening could be further reduced; the closing was necessarily more rapid, the concussion was nearly avoided, and the passage of the water was rendered direct and free from bends and interruptions. A valve on this construction was adapted to the engine at the Lambeth Water-works, and it was found on setting it to work, that a counterbalance weight of upwards of one ton, required to be moved from the pump side of the beam, to some distance on the steam piston side; the saving of steam consequent on this and the action of the valve, amounted to about seven per cent. of the quantity previously used. The same effect was observed at the Chelsea Water-works, where similar valves were substituted for those of Messrs. Harvey and West.

It is stated that in consequence of the galvanic action between the brass rings and the iron seatings, wood seatings were adopted, and have been found very preferable. The dimensions of all these valves are given in detail, and also of several other large valves which have been made.

The question of the proper weight of valves in proportion to the height of the column is then examined at great length, and the following rule is given: "The mean velocity of the water in feet per second through the valve, being ascertained, one-half more is added to this velocity and considered as the maximum velocity of the water through the valve; and the height of the head of water being found that would produce this velocity, every 1¾ inch of such height is considered equal to one ounce weight avoirdupois, acting upon each square inch of the area of the valve, against which the water impinges, in its passage to the pump barrel, allowance being made for the difference of the weight of the ring, when immersed in water, compared with its weight in the air." By this rule, it was found that a considerable weight required to be added to the valves which had been erected, and that addition rendered the concussion scarcely perceptible.

The author advocates a large area in the valve passages for the water to flow through, in order that the power of the engine may not be expended in putting the fluid in motion to fill the pump-barrel. He states that the proper area, depends on the diameter of the pump and the working velocity of the plunger; and that if the maximum velocity of the water up the suction pipe, is not allowed to exceed 6 feet per second, but little advantage will in ordinary cases be gained by reducing that velocity; that an increase of speed is often unavoidable, but that it causes a great expenditure of power; and he quotes Mr. Wicksteed's experiments in support of this position. He urges from this, the importance of reducing the velocity of the water in entering and in quitting the pump barrel; and also that the lift of the valve should not exceed 2 inches, and should be as much less as possible, as the valve in that case closes quickly before the return stroke of the engine commences. Short lifts are then examined, and it is stated that the valves will not close rapidly, unless they are weighted sufficiently to resist the maximum velocity of the water flowing through them and are carefully adjusted to it; and that if they are too heavy there is a loss of power in working the pumps.

Several modifications of these valves, adapted to various uses, are then described, and the author states that his intention is, to lay before the Institution, an account of such valves as had been found to answer well in practice; and to direct attention to the correct principles for constructing them of proper proportions and of durable materials.

The paper is illustrated by eight detailed drawings of different constructions of valves, and by three models of some which have been in use and are found successful.

Remarks.—Mr. Simpson corroborated the account of the advantages of the valves described in the paper; he had found them practically useful and economical.

Mr. Wicksteed said that with Messrs. Harvey and West's improvements, a valve 4 feet in diameter which formerly rose between 4 inches and 5 inches, now only lifted 1¼ inch; the concussion was diminished and the durability insured; the latter was increased by substituting wooden faces for metal ones; by this means also the corrosion, attendant upon the contact of two metals, was avoided. One of these valves had already lasted three years, and was still quite good. The principal improvement consisted in making the water pass all round the circumference, instead of through the centre of the valve. The difficulties which had been experienced at Old Ford had not arisen from the form of the valves,[3] but from the situation in which they were placed; he argued, therefore, that when experiments were made upon these valves, new boxes and suction pipes should be made expressly for them, and they ought not to be adapted to the pipes from whence the old shaped valves had been taken. He approved particularly of the form of the double-beat valves as possessing great strength, and reducing the liability to fracture.

Mr. Taylor said, that the meeting was much indebted to the author, for laying down positive rules and principles, on a subject which had not hitherto

1 "An Experimental Inquiry concerning the Cornish and Boulton & Watt Pumping Engines," by Thomas Wicksteed. Weale, London, 1841.

2 See drawing and description of these valves in the Journal, Vol. III, p. 41.

3 We rather suspect that Mr. Wicksteed must have been misunderstood in his remarks, for we understood that he alluded to the use of two valves, and that he said the lower valve rose 4 or 5 inches, while the upper one rose from ¼ in. to 1¾ in. only.—[Ed. C. E. & A. Journal.]

been sufficiently attended to. He fully approved of those forms of valves in which the area was divided into several openings; the loading the valve proportionably was also of importance. All the ring valves, among which he would include that of Mr. Hosking, tended to diminish the concussion; but however good they might appear theoretically, there were some practical objections against most of them; for instance, Harvey and West's valve was not applicable for mines, because, as the two lifting faces were connected, a chip or any sand being interposed between either of them would cause considerable leakage in both; the ring valves were not liable to this objection, and therefore were preferable for mines or situations where the water contained any foreign substances. The old butterfly leather valve had been much improved, and recently a modification of it had been introduced which promised to [illegible] effective. The area of the valve was divided into [illegible] compartments, each covered by a triangular flap of leather, hinged to the circumference of the bucket, and all meeting in the centre on a raised apex. By this arrangement nearly the whole area of the pump-valve was opened; the cost of construction was also diminished, because, instead of cutting the large flaps only out of the finest and largest hides of leather, small pieces could be used: valves thus constructed, had been in use in mines for upwards of seven months, without repair. The improvements in the valves had produced a corresponding increase in the height of the column of the pumps: it formerly was about 15 fathoms; Woolf had gradually increased it to 40 fathoms; and now a column of 50 fathoms was sometimes used. He was an advocate for giving a very large area to the suction-pipes; for instance, in one mine under his direction, to a valve 20 inches in diameter, two suction pipes, each of 20 inches diameter, had been adapted, with great advantage to the engine; the pump drew more water and worked much more steadily.

Mr. Parkes remarked, that the concussion arising from the closing of the valves of low-lift pumps, was more destructive than in the high-lifts; an entirely different system was therefore pursued in pumping. The engine started very rapidly, and was generally worked much faster, which altered the condition of the pumping. At the engine of the Waldersea drainage, near Wisbeach, there was a pump of 6 feet diameter, with a length of stroke of 8 feet, the valves were formerly destroyed more rapidly than in any mine in Cornwall; recently, Mr. Hosking, had adapted to it a large box, having in the centre a valve of 30 inches diameter, and around it five other valves, the sum of the area of the six valves being greater than that of the pump: the result was a great diminution of concussion, and consequent increased durability of the valves.

Mr. Glynn agreed with Mr. Taylor, in thinking that Messrs. Harvey and West's valves, were not so well adapted for mining purposes as they were for water-works, or for situations where only clean water was passed through them. Mr. Darlington had introduced a modification of the valve, which he thought would be very efficacious; it was being constructed by the Butterley Iron Company, and he would send a description of it to the Institution. This principle of large valves had been extended to blast engines; the size of the air-valves having been much increased, a corresponding advantage had been found in their duration, as well as in the work of the engine.

June 27.— The President in the Chair.

"*On the present State of the Streets of the Metropolis, and the importance of their amelioration.*" By Charles Cochrane, President of the Association for the Promotion of Improved Street Paving, &c.

This paper first refers to a Commission formed by the present Government, "for inquiring into and considering the most effectual means of improving the Metropolis, and of providing increased facilities of communication therein;" also to a Report of a Committee of the House of Commons, which recommends "that an institution should be formed expressly for ascertaining, by a succession of experiments, the best mode of constructing roads and keeping them in repair."

A brief history of the different kinds of carriage-ways and foot-pavements, is then given, showing that the resources of art and science have been but little consulted in their construction, which is illustrated by the system of making macadamized roads, their formation being nearly dependent upon the amount of traffic upon them. It is also stated that few, if any, improvements have been made in the method of forming granite pavements; the system practised twenty years since being nearly the same as at present, which is, to imbed the stones in the earth by means of mere manual strength, although, of late years, the aid of grouting has been occasionally brought into use. That in foot-pavements the same fault is perceptible, namely, the want of a good foundation, as the masons generally seem to think, that so long as the edges of the flags are well covered with mortar, and the work completed presents an uniform surface, the chief objects are accom-

It [illegible] stated that wood paving, of which 100,000 yards have been laid down in the metropolis, appears likely, from the successful trials which it has undergone, to be generally adopted, the only objection against it being, that it is slippery in wet weather; this evil is chiefly attributed to the mud which is brought from the other kinds of paving and allowed to remain on it. In all other respects, wood appears a superior material to any other hitherto employed, for making roads, both as regards its general economy and durability, as well as its facility of traction, and more especially its extreme cleanliness.

The question of cleansing streets is then entered upon, when it is shown that the oftener streets are cleansed, the less mud is created, whilst the attendant expenses are not increased and the roads are kept in better preservation. From calculations made by the municipal authorities at Manchester, on the relative advantages of machinery and manual labour, in cleansing the streets, the results of which are given in a table, it is shown that the extent of surface swept is the same, although not the extent of streets, arising from the more or less frequency of sweeping over the same surface; so that by cleansing the streets with Whitworth's street-sweeping machine, three times a week, the quantity of mud produced on the surface is five times less, than when they were swept by hand, twice in three weeks, and thirteen times less than when swept but once a week.

	Number of Yards swept.	Number of Loads removed.	Average No. of Ys. swept to produce a Ld.
District swept by machine three times per week	5,500,000	1,285	4,338
By manual labour:—			
Twice in 3 weeks, township, 1841-2	5,500,000	6,400	859
Once a-week „ 1838-9	5,500,000	17,000	343

The losses caused by the dust and dirt in the streets are stated to be very great; Mr. Mivart, of Mivart's Hotel, estimates his actual loss at about £865 per annum, whilst shop-keepers in Oxford-street and Regent-street, state that they lose annually from £30 to £300 per annum, by the destruction of their goods by the dust, &c.

Some suggestions are given for improving, repairing, and cleansing the streets, and it is stated that there are abundant means at present available, for keeping them comparatively free from mud, if machinery was properly employed.

"*On the relative merits of Granite and Wood Pavements and Macadamized Roads; derived from actual experience.*" By D. T. Hope (Liverpool).

In this communication the author alludes to the inefficiency of many of our finest specimens of paving, arising from the desire of reducing the outlay, but which, in reality, are executed and maintained at a great expenditure, without securing the advantages which the material is capable of affording, or the qualifications requisite for streets;—and to the cleanliness, comfort, and true economy, in having the work performed in the best manner, and employing material best calculated for producing all those advantages, which may be reasonably expected in streets of the present day.

The following requisites that a good road or pavement ought, in some degree, to possess, are laid down down as a standard, by which the respective systems are compared; and a certain value (according to the experiments on the several modes) attached to each, for the convenience of more obviously contrasting their several qualities, viz.—

1. A solid and compact structure, capable of resisting the effects of traffic, without being cut up into ruts and inequalities from other causes than mere abrasion.
2. Not requiring to be frequently repaired.
3. As much elasticity in the material, as may be useful in aiding the power in draught.
4. A firm and smooth surface, that the power employed may not require to be ever vaying.
5. Although comparatively smooth, to be free from slipperiness.
6. To afford a sure foot-hold for the horse.
7. Not liable to be seriously affected by the changes of the atmosphere, or by repairs.
8. An absence of mud and dust.
9. A freedom frpm noise.
10. To afford economy in transit.
11. An economy in the construction and maintenance, consistent with the preceding advantages.
12. Not subject to rapid abrasion.

It is shown that macadamizing has few, if any, advantages for public thoroughfares—arising from its rapid abrasion, the frequent application of new metal—the uncertainty of its condition, varying with every change of weather—the abundance of mud and dust—and the great expence of maintenance; and from the power employed in draught requiring to be so variable, that the cost of transit is not only increased, but the horse is often compelled to exert more power at one time or in one part of the street, than should ever be required of it. And also, that the advantages which may be claimed for macadamizing in streets, are attainable in other descriptions of paving, if proper attention be paid to their construction.

It is contended, from experience, that granite pavement can be laid down, so that the results will be superior to macadamizing, not only as regards economy of construction and maintenance, and power in draught, but also of the other qualities, with the single exception of noise, which, it is shown, need not be so great a disadvantage as to warrant its rejection; if the sets be well dressed, and properly laid, on a sufficient substratum, and if the sets are not used too broad, a sure foot-hold for the horse can at all times be had, besides contributing more to the solidity of structure, than the broad and shallow blocks so frequently employed.

By experiment, it appears that wood is a more efficient and durable material for paving, than stone of any description, and that it is capable of affording all the qualities required for our finest streets. In order to ascertain the best position of the fibre, for securing all the advantages which wood can afford, a minute table is given of the results of experiments, during a period of eighteen months, upon blocks with the fibre placed vertically and horizontally, and leaning at the intermediate angles; from this it appears that vertical blocks sustain less abrasion and less injury than those in any other position. A sound concrete substratum, is held to be an essential feature, in the successful application of wood for paving; and if blocks in a vertical position be laid down in a dry state, with close joints, the surface and structure can be maintained, under any change of weather, in a condition to resist any amount of traffic and heavy loads. It is shown that cohesion is not a fluctuating quality, for the blocks in the pavement are, in reality, not liable to become wet and dry with atmospheric changes. In wet weather they absorb as much moisture as they can contain, which increases their volume, and from which moisture they are never after totally free, even in the driest weather, as they still remain damp, and retain an excess of volume over the dry state in which they were originally laid down, more than sufficient for supplying perfect cohesion under any change of the atmosphere. It is also shown that wood does not produce mud and dust, and that slipperiness is therefore foreign to wood pavement; that its economy in maintenance, power in draught, cleanliness and comfort, are favourable recommendations;—and that wood is an efficient material for paving, whether subjected to wet, dry, or frosty weather.

Tables are then given, showing the results of the experiments in a condensed form, and from which it appears, that, the power of traction being in each 100 lb., the weight drawn on a level macadamized road, is on an average 27 cwt.; on a level granite pavement, 30½ cwt.; and on a level wood pavement 54⅝ cwt.

"On the Ventilation of Lighthouse Lamps; the points necessary to be observed, and the manner in which these have been or may be attained." By Professor Faraday, L.L.D., Hon. Mem. Inst. C. E., &c.

The author states that the fuel used in lighthouses for the production of light is almost universally oil, burnt in lamps of the Argand or Fresnel construction; and, from the nature and use of the buildings, it very often happens that a large quantity of oil is burnt in a short time, in a small chamber exposed to low temperature from without, the principal walls of the chamber being only the glass through which the light shines; and that these chambers being in very exposed situations, it is essential that the air within should not be subject to winds or partial draughts, which might interfere with the steady burning of the lamps.

If the chamber or lantern be not perfectly ventilated, the substances produced by combustion are diffused through the air, so that in winter, or damp weather, the water condenses on the cold glass windows, which, if the light be a fixed one, greatly impairs its brilliancy and efficiency, or, if the light be a revolving one, tends to confound the bright and dark periods together. The extent to which this may go, may be conceived, when it is considered that some lighthouses burn as much as twenty, or more, pints of oil in one winter's night, in a space of 12 or 14 feet diameter, and from 8 to 10 feet high, and that each pint of oil produces more than a pint of water; or, from this fact, that the ice on the glass within, derived from this source, has been found in some instances an eighth, and even a sixth, of an inch in thickness, and required to be scraped off with knives.

The carbonic acid makes the air unwholesome, but it is easily removed by an arrangement which carries off the water as vapour. One pound of oil in combustion produces about 1·06 pounds of water and 2·86 pounds of carbonic acid.

The author's plan is to ventilate the lamps themselves by fit flues, and then the air inside the lantern will always be as pure as the external air, yet having closed doors and windows, a calm lantern, and a bright glass.

In lighthouses there are certain conditions, to which the ventilating arrangement must itself submit, and if these are not conformed with, the plan would be discarded, however perfect its own particular effect might be. These conditions are chiefly, that it should not alter the burning of the oil or charring of the wicks—that it should not interfere with the cleaning, trimming, and practice of the lamps and reflectors—that it should not obstruct the light from the reflectors—that it should not, in any sudden gust or tempest, cause a downward blast or impulse on the flame of the lamp—that, if thrown out of action suddenly, it should not alter the burning; and, added to these, that it should perform its own ventilating functions perfectly.

Lighthouses have either one large central lamp, the outer wick of which is sometimes 3½ inches in diameter, or many single Argand burners, each with its own parabolic reflector. The former is a fixed lamp; the latter are frequently in motion. The former requires the simplest ventilating system, and is thus described:—

The ventilating pipe or chimney is a copper tube, 4 inches in diameter, not, however, in one length, but divided into three or four pieces: the lower end of each of these pieces, for about 1½ inch, is opened out into a conical form about 5½ inches in diameter at the lowest part. When the chimney is put together, the upper end of the bottom piece is inserted about ½ an inch into the cone of the next piece above, and fixed there by three ties or pins, so that the two pieces are firmly held together; but there is still plenty of air-way, or entrance, into the chimney between them. The same arrangement holds good with each succeeding piece. When the ventilating chimney is fixed in its place, it is adjusted, so that the lamp-chimney enters about half an inch into the lower cone, and the top of the ventilating chimney enters into the cowl or head of the lantern.

With this arrangement it is found that the action of the ventilating flue, is to carry up every portion of the products of combustion into the cowl; none passes by the cone apertures, out of the flue into the air of the lantern, but a portion of the air passes from the lantern by these apertures into the flue, and so the lantern itself is in some degree ventilated.

The important use of these cone apertures is, that when a sudden gust, or eddy of wind, strikes into the cowl of the lantern, it should not have any effect in disturbing or altering the flame. It is found that the wind may blow suddenly in at the cowl, and the effect never reaches the lamp. The upper, or the second, or the third, or even the fourth portion of the ventilating flue might be entirely closed, yet without altering the flame. The cone junctions in no way interfere with the tube in carrying up all the products of combustion; but if any downward current occurs, they dispose of the whole of it into the room, without ever affecting the lamp. The ventilating flue is, in fact, a tube which, as regards the lamp, can carry everything *up*, but conveys nothing *down*.

In lighthouses with many separate lamps and reflectors, the case is more difficult and the arrangement more complicated, yet the conditions before referred to are more imperatively called for, because any departure from them was found to have greater influence in producing harm. The object has been attained thus:—A system of gathering pipes has been applied to the lamps, which may be considered as having the different beginnings at each lamp, and being fixed to the frame which supports the lamps, is made to converge together and to the axis of the frame by curved lines. The object is to bring the tubes together behind the reflectors, as soon as convenient, joining two or more into one, like a system of veins, so that one ventilating flue may at last carry off the whole of the lamp products. It is found that a pipe ⅞ths of an inch in diameter is large enough for one lamp; and where, by junction, two or more pipes have become one, if the one pipe has a sectional area, proportionate to the number of lamps which it governs, the desired effect is obtained.

Each of the pipes ⅞ths of an inch in diameter, passes downwards through the aperture in the reflector over the lamp, and dips an inch into the lamp-glasses; it is able to gather and carry off all the products of combustion, though, perhaps, still 2 inches from the top of flame, and therefore not interfering in any respect with it, nor coming as a shade between it and any part of the reflector: the flame and reflector are as free in their relation to each other as they were before. Neither does this tube hide from the observer or mariner, a part of the reflector larger than about 1½ square inch of surface, and it allows of a compensation to two or three times the amount; for, when in its place, all the rest of the aperture over the lamp, which is left open and inefficient in the ordinary service, may be made effectual reflecting surface, simply by filling it up with a loose, fitly formed, reflecting plate.

At this termination of the ventilating flue an important adjustment is effected. If the tube dip about an inch into the lamp-glass, the draught up it is such that not only do all the products of combustion enter the tube, but air passes down between the top edge of the lamp-glass and the tube, going, finally, up the latter with the smoke. In this case, however, an evil is produced, for the wick is charred too rapidly; but if the ventilating flue descends until only level with the top of the lamp-glass, the whole of the burnt air does not usually go up it, but some passes out into the chamber, and at such times the charring of the wick is not hastened. Here, therefore, there is an adjusting power, and it was found by the trials made, that when the tube dipped about half an inch into the lamp-glass, it left the burning of the lamp unaltered, and yet carried off all the products of combustion.

The power already referred to, of dividing a chimney into separate and independent parts, and yet enabling it to act perfectly as a whole, as shown in the single central chimney, was easily applicable in the case of several lamps, and gave a double advantage; for it not only protected the lamps from any influence of down draught, but it easily admitted of the rotation of the system of gathering flues, fixed to the frame sustaining the lamps and reflectors in a revolving lighthouse, and of the delivery of the burnt air, &c., from its upper extremity into the upper immoveable portion of the flue. This capability in a revolving light is essential, for in all, the support of the frame-work is of such a nature, as to require that the upper part of the flue should be a fixture.

The author explains that it is as an officer of the Trinity House, and under its instructions, that he entered into the consideration of this subject: that, as to the central chimney, its action has been both proved and approved, and that all the central lights are ordered to be furnished with them; that

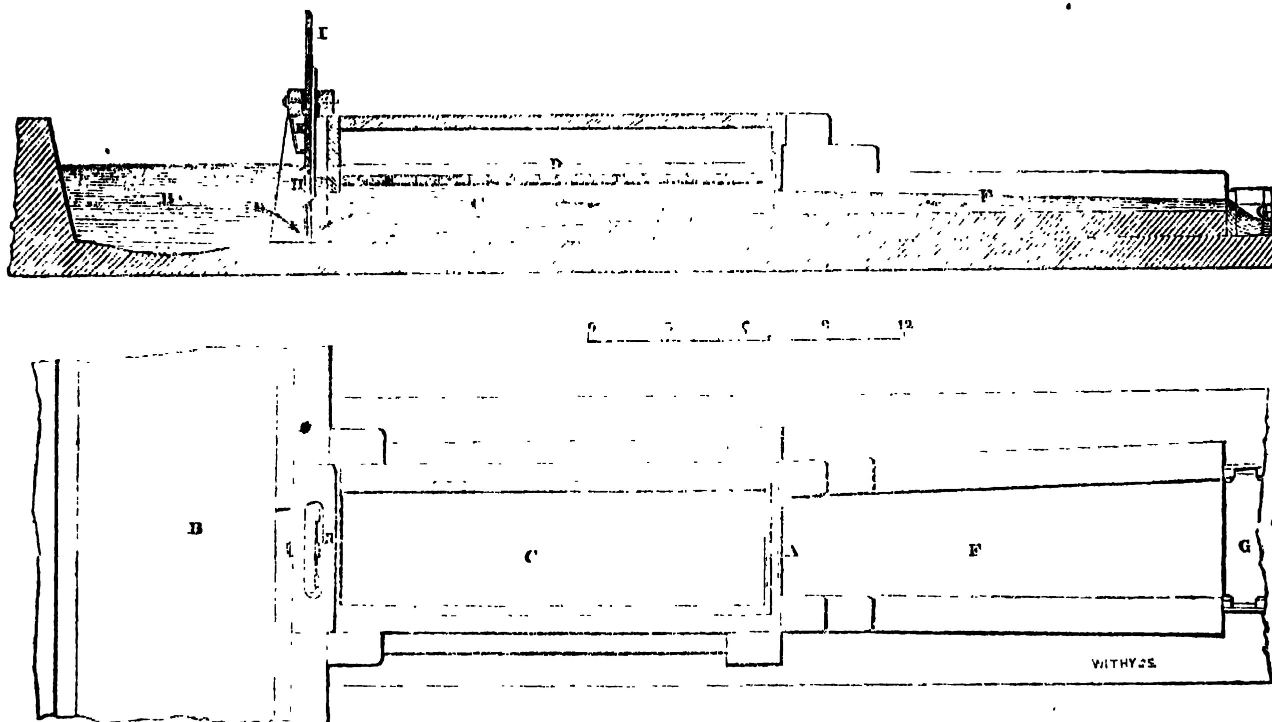
as respects the application to separate and revolving lamps, the experiment has been made under the direction of the Trinity House, on a face of six lamps, being a full-sized copy of the Tynemouth revolving light, and, so far to the satisfaction of the Deputy Master and Brethren, that the plan is to be applied immediately to two light-houses which suffer most from condensation on the glass; he believes it will be with full success.

A Lock-meter.

"*A model and drawing of a Lock-meter, used in Lombardy for measuring Water for Irrigation*," were presented by Benedetto Albano, M. Inst. C. E.

The author stated that the necessity for regulating the supply of water for irrigation, had induced the adoption in Lombardy of a meter, with an aperture of given dimensions, as a standard for the emission of water to the irrigating channels—this was termed the "*Bocche Magistrale*." This standard was called "*oncia d'acqua magistrale*," by which was understood, a quantity of water flowing through a given aperture, under an unvarying pressure, permitting only the passage of a certain quantity per minute. This "*oncia d'acqua*" has now been ascertained by Krenzlin (Inspector General of Canals, Milan) to be equal to 2·12 cubic metres per minute, and is now the received authority; and the system is adopted through the Lombardian and Venetian Kingdoms, and other provinces of Italy. This quantity is supposing the flow to be through an aperture 3 *oncie*[3] wide by 4 high, and with a head of water of 2 *oncie*. An oncia is equal to 1·95 inches.

The structure consists of an aperture A, where the water is measured, nearly 8 inches high, 16 inches broad, and 6 inches long, leading to which is the channel C, 20 feet long, which has a floor inclined to the supplying stream B, at an angle of 1 in 15; this channel is covered by a horizontal close boarding or ceiling D, by which the undulatory motion of the water is checked and any air is prevented from getting into the channel, while the height of the head is restricted to 4 inches above the aperture A. At the end is a sluice-gate H, of the same width as the aperture A, to be raised by a rack I; on the gate is a block K, to prevent its being raised too high, and a bolt and lock secure it. The discharge channel F, is about 18 feet long, is inclined 1 in 108, and widens about [illegible] ches at each side, diverging outwards nearly 6 inches in the entire length. Care must be taken that the water in the channel at G, is always kept below the bed of the channel F. The sluice-gate being opened sufficiently to fill the covered channel up to the ceiling, the quantity of water flowing through the aperture is accurately measured. Just behind the sluice there is a small opening to see when the water has reached the proper level. The aperture A, to this metre will allow a discharge of 12·72 cubic metres, or 449 cubic feet, English measurement, per minute; beyond these proportions the aperture is not allowed to be increased, as there would be a sensible error in the quantity on account of the *vena contracta*.



"*On the Pressure and Density of Steam, with a proposed new formula for the relation between them; applicable particularly to Engines working with high-pressure Steam expansively.*" By William Pole, Assoc. Inst. C. E.

The relations between the elasticity, temperature, and density of steam have long been interesting and important subjects of philosophical research. The connexion of the two former, namely, pressure and temperature, with each other, has excited the greatest attention, numerous experiments having been undertaken to ascertain the values of them at all points of the scale, and many formulæ proposed by English and foreign mathematicians, to express approximately the relation between them.[3]

The pressure and temperature being known, the density, or what answers the same purpose, the relative volume, compared with the water which has produced it, may be deduced by a combination of the laws of Boyle[4] and Gay Lussac;[5] and may be expressed algebraically in terms of the pressure and temperature combined; whence, by eliminating the latter, by means of the before-mentioned formulæ, expressions can be arrived at which will connect at once the volume with the pressure.

But there are several difficulties in the way of this process, the equations which may be thus obtained being too complicated for practical use; and therefore, since it is important in calculations connected with steam and the steam-engine, to find a tolerably accurate, and at the same time, simple rule which shall give the pressure and volume directly in terms of each other, the empirical method has been resorted to.

The paper enumerates three formulæ given for this purpose by M. Navier and M. de Pambour, explaining the peculiar cases to which they are applicable, and those in which they fail; and the author then proposes a fourth expression, which is intended to meet a case not provided for by either of the others, namely, for "condensing engines working with high-pressure steam expansively;" such as the Cornish, and Woolf's double cylinder engine. The equation is—

$$P = \frac{24250}{V-65},$$

$$\text{or reciprocally, } V = \frac{24250}{P} + 65.$$

P being the total pressure of the steam in lb. per square inch, and V its relative volume, compared with that of its constituent water.

These formulæ may be adopted without considerable error, throughout the range generally required in such engines, viz., from about 5 lb. to 65 lb. per square inch.

Two tables are then given showing the pressures and volumes as calcu

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[3] Upwards of twenty different formulæ of this nature are given in the *Encyclopædia Britannica*, 7th edition, art. "Steam," where their respective merits and correspondence with the results of experiment, are amply investigated.

[4] That "if the temperature remain constant, the density varies directly as the pressure."

[5] That "if the pressure remain constant, and the temperature change, the volume receives a certain definite amount of augmentation, for each degree of temperature added, or *vice versâ*." This augmentation is equal ·00208 of the volume at freezing point, for each degree of Fahrenheit, or ·00375 for each degree Centigrade.

lated for every 5 lb. pressure in this scale; they show a comparison of the results of the four formulæ with each other, and the respective amount of deviation from truth in each.

The greatest error is—

	lb.	
By M. Navier's formula ..	1·31	per square inch.
M. de Pambour's first ditto	1·12	"
" " second ditto	2·75	"
The new formula ..	·71	"

The mean error is—

	lb.	
By M. Navier's formula	0·245	per square inch.
M. de Pambour's first ditto	1·12	"
" " second ditto	0·35	..
The new formula ..	0·0062	..

The tables also show .—

1st. That the new formula is nearer the truth than either of the others taken separately, in three-fourths of the scale.

2nd. That it is nearer than all three combined, in half the scale.

3rd. That the greatest error of the new formula, with regard to the pressures, is only about half as great as that of the most correct of the other three.

4th. That the mean error is only one-fortieth of either of the others, and only equal to about one-tenth of an ounce per square inch.

5th. That the errors in the volumes are much less numerous and important with the new formula than with either of the others.

It is also added that the new expression is simpler in algebraical form than the others; it is more easily calculated, the constants are easier to remember, and that no alteration of the constants in the other formulæ will make them coincide so nearly with the truth as the new one does.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

Monday, November 4.—W. Tite, Esq. v.p., f.r.s. in the Chair.

He opened the proceedings of the session by making some observations in explanation of what he had stated at the concluding meeting of the last session. He alluded to what he had said as to the effect of the growing tendency to introduce Gothic architecture. What he intended to affirm was that it was not the duty of the architect to make a servile copy from the works of the ancients, but to avail himself of them only as exemplifications of the great principles which would require adaptation for modern edifices. In allusion to this subject he pointed out the advantage of studying the remains of the domestic architecture of the time of Edward III., as useful studies in the present day. So far from disapproving of the legitimate study of Gothic architecture he congratulated the members on the numerous restorations of ancient monuments in that style which were daily assuming all their ancient beauty. All he had wished to do was to caution junior members against the exclusive study of that style and the neglect of the classic monuments of Greece and Italy, which he considered to offer more suitable types for domestic edifices, and he reminded them of the excellent examples set them in this respect by Inigo Jones and Wren.

He then proceeded to give some account of his tour into Germany during the last summer, when he had an opportunity of viewing the Walhalla (described in our *Journal* for April and May last, and accompanied with a view of the exterior & interior). He stated that the building was well studied, its situation admirable, and the blending of architecture, sculpture and painting exquisite, while the colouring is not so elaborate or so glaring as to make the contrast too great. In passing through the town of Ulm in Wirtemburgh he visited the cathedral which he described as a very fine building, and well deserving the inspection of architects who may be travelling in Germany; although it is a Lutheran church, there are several objects well deserving of notice, it has four aisles with arches supporting a clerestory. The wood carving in the choir is extremely good. There is also a fine specimen of architecture, the tabernacle for the host, which is on the north side of the choir. In Munich he considered colouring was carried too far, the effect of colouring in external decoration not being good. For example the Theatre at Munich is a very fine building; it has a portico with a pediment, the tympanum of which is painted in fresco; at the back of this pediment is a second pediment also painted, the effect of which is extremely harsh. He then referred to the prevailing style of architecture in Munich, of which he said the two principal buildings were in the Byzantine style. The Basilica now being erected is in that style and well adapted to exhibit the effect of gilding. The library is in the Florentine style, but the external colouring is not well introduced. Mr. Tite then observed that from what he saw at Munich, and from the present tendency in England colour and decoration would be carried too far and likely to run into excess, although good in interiors the quantity of gold requires light, and consequently is not in some cases so well suited for ceilings. The roof of the Basilica is a queen-post roof and the interior is opened to the hall, the rafters are decorated as well as the other timbers, but the poverty of the materials is rather unfortunate as they are not well suited for decoration. The mode of building adopted in Munich has not the advantage we possess of the use of iron. Upon this point Mr. Tite advised the young architect to obtain a thorough knowledge, and learn the circumstances in which this metal might be advantageously introduced. In the course of the present session he promised to say something relative to the best form of beams, and as to the introduction of iron generally for architectural purposes.

Professor Donaldson then read a paper describing thirteen models of churches found in Henry the 5th, Chantry at Westminster Abbey, they were designs submitted to the Commissioners appointed in the reign of Queen Ann for building of forty churches in the metropolis but only three out of the thirteen models had been erected, viz., the New Church, Strand, Greenwich Church, and St. James' Westminster; the others were designs of a high class, and he considered it a great loss to the architectural character of the metropolis that they were never carried into effect. The models are well executed and in good preservation, and it is to be regretted that they are not opened to public inspection.

Professor Donaldson also made some observations on the application of fresco by the old Italian masters to the exterior of buildings for decoration, and exhibited an original drawing by Polidoro in illustration. He then read a letter from Mr. Crace, of Wigmore Street, giving to.. account of the frescos which had fallen under his notice during a recent tour in Germany and the north of Italy. Mr. Crace observes "that in Italy, Switzerland, and the south of Germany, the paintings in fresco are so general, that there is scarcely a town in which, both in the exterior and in the interior of the houses, some are not to be met with. In Italy this kind of decoration is the most frequent; *there*, in many cases, the architectural effects seem to have been arranged, with the view of being afterwards aided by painting; the enrichments of the mouldings and the ornaments being given in chiaro oscuro. In other cases, again, the whole surface of the wall is covered with historical or allegorical and ornamental painting. My principal object in travelling was, firstly, to learn the processes employed in fresco and encaustic painting; secondly, to form an opinion as to the effects produced; and thirdly, to judge how far those effects would surpass painting in oil, in appearance and durability. For the two first reasons it was, therefore, the modern specimens of the art, to which my attention was principally directed. At the Royal Palace at Venice, I noticed decorations lately executed in fresco; but it was at Munich that I saw the art most extensively employed. In this city it is to be met with in every modern public building. In the church of St. Louis is the grand picture of the Last Judgment by Cornelius, and other frescos of considerable merit by his pupils. In the All Saints' Chapel (Aller Heilige Capelle) are some beautiful paintings by Hess and his pupils, on a gold ground. At the basilica of St. Bonifacius, so splendidly decorated, Hess and others are employed at this time on a series of grand paintings; at the Glyptothek are the frescos of Cornelius; at the Pynacothek, those by Zimmerman and others; and at the two Royal Palaces, each room is adorned by some artist of excellence, either in fresco or encaustic. In addition to these interiors there are examples of exterior decorations at the Hof Garden, the façade of the Post Office, and the Theatre. The process of painting in fresco, though attended with certain difficulties, is easily learnt with ordinary perseverance. The effects produced surpass painting in oil in solidity and clearness; but owing to the limitation of colours employed, there always appeared to me a certain yellow brown dry effect, and a want of the richness of paintings in oil. In the grand fresco by Cornelius of the Last Judgment, I think this must be felt by all; and in the beautiful composition by Veith at Frankfort, this defect is still more apparent.

"The manual operation I found, to my surprise, to be by no means rapid, even by the practised hands. One of the most distinguished artists I noticed painting a broad fold in the drapery of a monk, he used a small brush, and gained his effects by repeated touches. The ground of lime and sand requires to be touched with delicacy. The pictures in execution at the Basilica, take, I was informed by one of the artists, nearly a twelve month to execute. The cartoons and pounces are prepared in the winter months, and the painting is done during the summer. In ornament too, I observed that the work was not quicker than in oil, and much slower than in distemper to which it is superior as bearing washing, but inferior in the brilliancy of colouring. As to the durability of fresco in the older examples that I noticed in Italy, though the paintings had preserved to a considerable extent their original colouring, yet the effect was in almost all cases impaired by the decay of the plaster ground, the surface of which had crumbled through the action of the atmosphere. At Venice where works on a grand scale have been executed in both fresco, and oil, I was curious to compare the relative defects and advantages of each, and found, that though the paintings in oil of some masters had much darkened, yet that with others, particularly Paul Veronese, the effects were still clean and fresh, and, upon the whole, being in better preservation, surpassed the actual appearance of most of the frescos. In the grand works lately executed at Munich they have been too recently done to allow of an opinion being formed, yet, in the exterior specimens at the post office, and the Hof Garden, signs of decay are very evident. Upon the whole, reflecting upon all I saw, considering the difficulties of execution, the liability of decay in the ground, and the impossibility of reparation if injured, I could not perceive any great advantages over oil; in this country must be further added the additional likelihood of decay, from our damp climate, and discolouration through smoke and fog; on the one side it has great advantages in being seen to perfection in all lights, and therefore particularly ad-

vantageous for paintings of architectural effects in its clearness, and the soundness of its colour; on the other side, the disadvantages I have enumerated above."

After the reading of Mr. Crace's paper some observations were made by the Vice President and other members on the effect of fresco. An anecdote was related respecting Cornelius that when the King of Bavaria was viewing his famous fresco of the Last Judgment, he observed to Cornelius that it appeared as if it were three centuries old, Cornelius replied, "That is just what I wanted." It was also observed that it was surprising what a golden effect was produced by simple colours, although done in dry and unshining materials. In Munich the bricks are well burnt notwithstanding they are absorbent, the lime is very good and a large quantity of it is used in proportion to sand. The bricks are laid with open joints, the plastering is first laid on with a hand float, afterwards the fine coat to take the fresco is laid on by the plasterer, who comes the first thing in the morning and puts on just sufficient for the artist to work upon during the same day, and which this latter must finish before it is dry. The difficulty in England will be to get rid of the efflorescence of saltpetre, which can be removed by repeated washing. The frescos by Aglio in Moorfields chapel appears to have failed on this account.

Mr. Arthur Johnson was presented with a prize consisting of the first volume of the Transactions of the Institute for the best sketches sent in by the pupils during the last session.

November 2[illegible], 1843.—W. Tite, Esq. V.P. in the Chair.

A highly interesting and practical paper on Timber and Deals [illegible] read which is given in full in another part of the *Journal*.

Observations.—After the paper was read Mr. Tite observed that it was exactly applicable to the practical architect, it is quite useless for architects to introduce into their specifications the quality of materials to be used without they are able to ascertain that the contractor has complied with the stipulations of the contract. He adverted to the proper use of deals; nothing was so injurious or vexatious as the introduction of unseasoned deals, although they appear to be quite dry; this can only be avoided by a practical knowledge of the quality of timber and deals on the part of the architect. Respecting timber the trifling difference in the price of Baltic and pine timber was now so trifling that it was not worth while to introduce the latter, there is something in it which renders it liable to the dry rot.

In London there is scarcely any other deals introduced but what were named in the paper just read, but in other parts of England, and abroad, there were other materials used; at Liverpool the floor of the Custom House consists of narrow boards cut out of Riga timber which was stacked with great care for some years; it was laid in widths of five inches with sawn edges quite close, and afterwards planed. In France they knew of no deals, they used boards cut out of the best Memel timber in every variety of joiners' work. In Scotland yellow pine was used to a great extent in joiners' work without being painted, it is very durable if not covered up. At one of the meetings during the last session he stated that the Great Western rails were laid on yellow pine timbers, and that they had been taken up in consequence of the failure of the Kyanizing; he has since ascertained that that was not the case, for the timbers which had been Kyanized were found to be perfectly sound when taken up, and that the reason for removing them was to lay down sleepers of larger dimensions. He observed that in Switzerland, a country very much exposed to a moist climate, the growth of moss, &c., that the timbers were not painted, although very much exposed, notwithstanding that many were 150 to 200 years old it was very rare to see any symptom of decay. Silver pine is used; it may be seen growing in trees 160ft. to 170ft. and even from 200ft. to 230ft. high without a branch, 20in. girth, (? ¼ girth) none of it is converted for the European market. In France oak is felled in the autumn, and in no other time of the year, under a heavy penalty, but in England it is felled in the spring with the sap in it for the sake of the bark, consequently it is very liable to decay, and to be attacked with the dry rot, the sap being a pabulum for the latter, now that the price of bark was low, it is hardly worth the practice of felling it in the spring, considering the difference in the value, with that which is felled in the autumn.

Mr. Tite also made some observations on the introduction of large timbers in the construction of warehouse floors, formerly the joists were carried on girders of whole timber about 14 in. square laid from wall to wall on caps on top of posts, and he has known where a large knot happened to come near the bearings the timber to split up; he has seen the upper floor of warehouses which were heavily laden depressed full 15 in. which so compressed the vertical posts, and caused them to *eat* into the timber girders, that when the weight was removed the floors sprang up again and all the posts became quite loose, so much so that it was found necessary to drive a wedge under each post on every floor. He never used whole timber for girders but always forms them of two pieces of timber 14 in. deep by 9 in. or 10 in. reversed, and lays them on iron caps fitted on to the top of the posts or iron stanchions, and instead of the posts above standing on the girders, a dowel, or pin, is inserted between the two pieces of timber forming the girder, and between the head of the post below and the base of the columns above this discharging the weight vertically through the posts, by which means the girders have only to carry the weight of each separate floor.

A gentleman present observed that there was a great variety of timber used on the continent unknown to this country, he instanced the mountains of Switzerland which might supply us with fine timber; in one of the Cantons is a timber suitable for lining walls, wainscotting, &c., it is called "stone pine," it is of slow growth which ensures durability, it also has a peculiar fragrance. In Scotland a great deal of valuable timber (larch) has been planted by the Duke of Athol, which being free from duty might be advantageously introduced into England, he also stated that timber might be preserved from the attacks of dry rot by washing it over, particularly the ends, with *impure pyroligneous acid retaining the creosote*.

It was also noticed by a member that yellow pine was used almost exclusively in Glasgow, and a considerable portion in Liverpool and Manchester, at the latter place, Mr. Bellhouse, an extensive builder, has given the preference to yellow pine for many years[1].

Mr. Hiscock stated that two houses being built under his direction, at Stones' end in the Borough, the proprietor did not intend to use any paint for the joinery, but simply use varnish.

ON THE MODERN PRACTICE OF COMPETITION.

In our number for March, 1842, we gave a full report of Professor Hosking's Introductory Lecture, then lately delivered at King's College, on the Principles and Practice of Architecture. In this lecture Mr. Hosking took occasion to denounce the system of submitting designs in competition upon speculation, and he afterwards published his lecture in a separate form, and then added to it as an appendix, "Further remarks on the modern practice of competition." Late in the last session of the Royal Institute of British Architects, a special general meeting of the members was summoned to consider a resolution upon the same subject; but the attendance of members was so thin, that the subject was adjourned until the next session, some time in the present month being named for it. Although it does not appear in the circular with whom the proposed resolution originated, there seems to be no need for hesitation in attributing it to the author of the above-mentioned lecture and of the "Further Remarks;" and as the time is now approaching for the discussion, we have thought that we may perform a useful service in transferring some of Mr Hosking's "Further Remarks" to our pages, to prepare the members of the Institute at large for the consideration of the subject by a knowledge of the reasons upon which the resolution has been founded.

The resolution is as follows:—"That the modern practice of submitting designs in competing speculations for premiums, or for employment, or in any competition for preference without specific or properly implied promise of certain payment to each and every competitor, operates injuriously upon architecture, and upon the interests and character of the profession."

"It is a most offensive feature of the modern gambling and degrading system of competition that all Architects are supposed to pursue the game, so that successful intriguers who do follow it, are supposed to be the only meritorious practitioners, at the expense of those who have never fallen from virtue, or who, having fallen, have seen their error, and repented. This feature of the system is not only offensive to those who see the folly and avoid

[1] Mr. John Miller, a ship-owner at Liverpool, largely engaged in the importation of timber from the colonies, stated in his evidence before the Parliamentary Committee in answer to some questions put to him regarding North American yellow pine timber:—"I know that Mr. Bellhouse, who is the largest dealer in Manchester, has changed the views he formerly entertained as to the comparative merits of the two timbers, and that he now gives a decided preference to the timber from the Colonies. For all purposes, he, in building large warehouses, has latterly consumed Canadian yellow pine in preference to Canadian red, or Dantzic, or Memel. He states, I think, that he consumes about fifty cargoes a year; and even when he can get lengths of Canadian red timber, or Memel timber to suit the purpose, he uses in preference Canada yellow pine, and he states his reason that, for the last fifteen years he has been a close observer of the different qualities of timber, and the different effects produced upon it by exposure to air and influence of atmosphere, and he finds that when the yellow pine of Canada is introduced into brick and mortar, the ends are little liable to decay, and that the ends either of the red pine timber from Canada, or of Memel and Dantzic timber, are more liable to decay. This opinion of Mr. Bellhouse is the result of long experience, and is a change from his former opinion. In Glasgow, where I know at first they used for building purposes nothing but Baltic timber, year (1835) I wrote to Glasgow to a correspondent of my own, a large dealer in timber, to give me a statement of the proportions of each sort in consumption there, and he told me that the whole consumption in Glasgow of Baltic timber last year was not 200 loads."

it, but it is injurious to the public. Most persons upon whom the duty devolves of procuring designs for intended buildings are imposed upon by a notion that, in advertising for anonymous designs, they secure the advantage of designs from men of character and matured judgment; but as few such ever respond to the call in ordinary cases, the great bulk of competition business falls into the hands of the intriguing jobbers, and the public and the profession are both cheated.

"Even in the case of the houses of Parliament, which has been thought by many to afford the fullest justification of the system of general or public competition, because of its apparent successful result, the public possibly suffered irremediable injury. The principal public works of the preceding twenty or thirty years had been committed absolutely to a few practitioners, who ought, therefore, to be supposed the most competent, or at least, among the most competent, Architects the country afforded. It might be readily determined that such men would not enter into the sort of competition that was established; and so it happened that they did not; and the nation lost the application of the knowledge, experience, and taste of those who were, or who ought to have been, the best qualified, when seeking designs for one of the most important public works that a nation can have to devise. Either this was a great advantage lost, or the nation had been greatly wronged for a long series of years by the committal of its public works to men whose loss in such a case was no disadvantage? But it may be confidently assumed that, if the successful candidate in the competition that took place for the Houses of Parliament had been established in practice and reputation at the time of the competition as he must find himself now, no design would have been forthcoming from him. The successful competitor for the Houses of Parliament sent no design for the Royal Exchange, and surely the talent of the Architect, to whom pre-eminence had been so universally accorded in the case of the Palace of the Legislature ought to have been secured in procuring a choice of designs for the Forum of Commerce.

"It must be remembered, nevertheless, that the all-important limitation of cost was not imposed upon the Houses of Parliament Designs—and the source of much of the difficulty in ordinary cases did not therefore exist. With the Royal Exchange this difficulty presented itself, and, in an endeavour to act justly, the grossest injustice was done; the viciousness of the system prevailing against an apparently sincere desire to do well, until, at length, the matter was decided in a contest of interest between two Architects, neither of whom was understood to have taken part in the public *Competition*, and if either had done so, his design had been passed over in the original selection as of inferior merit! * * *

"The present writer has already pointed out in the foregoing Lecture the only efficient remedy, as he believes, for the abuses of the existing system of competition; and it is in the hands of the profession to adopt it and leave the public to seek its remedy. The "profession" cannot, of course, compel but by the example of individual members of it acting upon all, and by making it evident that every man must be himself the example who would bear an honourable standing among his fellows. * *

"The public ought to understand, however, that what is generally required in a competition *cannot* be fully and honestly complied with by either party. It is one thing to make a design for a building of the kind and capacity required—it is another thing to arrange such design in detail, that the cost of executing it may be accurately estimated—it is still another thing to specify particularly all the materials, and their various kinds, qualities, and capacities, the operations to which the materials shall be subjected, and the quantity and quality of the labour or workmanship that shall be bestowed upon them respectively—and it is still a further operation to estimate from the detailed drawings and particularized specifications what the cost of the building must be. All these things should be done, nevertheless, and by every competitor, when the cost is a condition; and, moreover, every design so elaborated should be fully investigated in all its details, or the conditions of the competition are not fulfilled by the parties imposing them. Now, conscientious men, having entered upon a competition, are compelled to limit the extent and appearance of their design to the means set forth in the "conditions," and to satisfy their own minds that it can be carried out as the parties requiring it expect, within those means. The most conscientious, however, cannot do all that ought to be done to make the conditions complete—*cannot*, because of the immense disproportion between the labour and expense which such fulfilment would involve, and the probability that the labour and expense so applied will not be of the slightest value. But the practice has been, and is, and it always will be, with bodies of men, be they small or large, committees, or the public in general, to look at externals—at the mere outside; and they are influenced by the effect produced in or by the prettiness of the drawings or models in which the design presents itself; the merits or demerits of the "plan," as architects understand the term—the kinds and qualities of materials and workmanship—the extent of enrichment in detail—and the thousand other things that go to affect the merit of a design and its compliance or non-compliance with the "conditions," are neither attended to nor understood; the effect of the design as to its decorative disposition is the utmost that they perceive, and the decision takes place accordingly. Hence it is that the conscientious man must always be an unsuccessful public competitor when cost is a condition. Even in the notorious case of the Royal Exchange, which might appear to contradict this, the reputedly successful conscientious competitor was still, for any value attachable to success, unsuccessful. * * *

"In truth, the public or their committees ask for *too much*, having reference to what they *really want*. Let the requirement be confined to a general design of a building of the particular kind required—of certain capacity—and adapted to a particular site—and to be built of certain main constituent materials.—Stipulate for a particular scale, and that the designs shall be presented in drawings—in outline, or tinted—and of what particular tint or tints alone—and, if perspective views are desired—fix the point or points of view. More will not then be required than most Architects would be willing to engage themselves upon a comparatively small fee, giving the public thereby the advantage of Competition, as far as it can be made of any use, without involving the great expense that elaborated designs must occasion. The one, two, and three hundred pound premiums, now held out to gambling crowds, might then be divided into twenty, thirty, forty, or fifty guinea fees, according to the circumstances of the case, and offered to such practitioners as might be known, or whose latent "talent," committees, or individual members of committees, might desire to draw out or encourage; and as no man educated to a liberal profession is without some connexions to whom it will happen to be able to give a helping hand, by nominating him, or procuring him to be nominated, upon one such Competition or other, all "talent" *connected with knowledge and supported by character* might emerge from the greatest obscurity in which it is to be found *so associated*. The successful competitor under such circumstances might be trusted to carry out his design in detail, adapting it to all the circumstances of the case much better than he could have done in a general Competition.

"In an endeavour to convince Architects, as a PROFESSION, in what their true interest consists, it is, perhaps, but proper to have pointed out to the public that the present system of Competition represses the honourable candidate for reputation and employment, by rendering it impossible for him to compete on equal terms with the unscrupulous, and that, consequently, the public are thrown into the hands of the latter; and to have pointed out also, that there is a reasonable course that may be pursued by which all the advantages of Competition are to be obtained, although Architects refuse any longer to lend themselves to gambling speculations.

The public will, nevertheless, go on as they have gone on until Architects, as a PROFESSION, shall have declined any longer to degrade and beggar themselves. It is, therefore, not a question proposed to the public,—and it is one indeed with which the public have nothing to do, beyond the interest which the public have in raising the character of the PROFESSION of Architecture, but which they will never recognise while they think they benefit by its debasement. *It is a matter to be determined by the Architects themselves*; and it may, perhaps, be hoped that this exposition of the abuse the PROFESSION labour under will induce all who are not quite besotted with the vice to consider the question in this, its true point of view; and, having so considered it, there can be, it may be further hoped, no doubt that all those who have any sense of HONOUR and VIRTUE, or, indeed any SELF-RESPECT, remaining, will no longer lend themselves to the present degrading system, and it will soon cease to exist among us.

October, 1842.

REVIEWS.

Penny Cyclopædia. Art. "WINDOW."

The part of this excellent Cyclopædia, which will be published on the same day as this number of our own *Journal*, is, we believe, the final one, and thus a very arduous undertaking will have been successfully accomplished, after being carried on for eleven years, not only with the same diligence as at first, but, if anything, with an increased degree of it. We have, indeed, seen querulous and even reproachful observations as to the extent to which the work was being carried on; but we think all—even the most impatient, must now rejoice that it was not brought to a close within the number of volumes originally contemplated, and which it has exceeded by three. Had there been any kind of stoppages, or want of punctuality, there would have been some grounds for complaint, and there might have been great uncertainty as to when it would be finished, yet it has invariably been brought out regularly from its first commencement, which is much more than can be said for every other work of the kind. Others, too, there are, which have been hurried on towards their close that they may be said to have been finished without being completed, the articles in the later letters of the alphabet bearing no sort of proportion to those in the earlier ones; and such has been the case in regard to two architectural dictionaries.

Fortunately it is quite the reverse with this Cyclopædia, since the two last volumes contain several articles which, interesting as they are in themselves, might have been omitted, as the omission could have been neither detected nor complained of. Among them are several additions to architectural biography, including the names of *Voronikhin*, *Weinbrenner*, *Wiebeking*, *Wilkins*, and *Wood* of Bath, the last of whom has found no place in any English biographical

work—at least none of the many we have referred to for it—although he has been dead these eighty years; nor can it be alleged that he was too obscure in his profession for notice, since the man who made nearly an entire city his own monument, deserves to be recorded quite as much as the illustrious Nash—we do not mean the architect, but the "beau."

"*Walhalla*,"—the so-called structure near Regensburg, which is here fully described, is also an article which it was not absolutely indispensable to give, and the same may be said of "*Windsor Castle*," yet articles of this class are a very great improvement upon what was done at first. We shall confine ourselves, however, for extracts, to the article "Window," although it is one that ought to be read entire.

"It is one very great advantage of the Gothic or Pointed style, that there the windows derive strong architectural expression from the apertures themselves; which, with the mullions, transoms, and tracery inserted in them, mainly form the design and decoration; while the external mouldings and ornaments contribute to them only in a subordinate degree. Consequently, if others quite plain, the windows can never appear mere vacant spaces. Widely different is it in those styles where the ornamental design is confined to the mere exterior or framing of the aperture: therefore, however they may be so decorated, the openings will, if of very large dimensions, always have a vacant look, and the glazing of the windows will appear to be in want of adequate support. Such is the case with the windows of St. Paul's, where the apertures are filled in only with very ordinary glazing in small panes, and consequently are so far from being pleasing, as to produce a sombre, dingy appearance: whereas in Gothic windows the glazing shows itself to be firmly supported by the mullion, and is never extended over such large unbroken surfaces, let the size of the window be what it may, as to produce an effect of blankness. It is another advantage peculiar to that style that it allows windows to be of any dimensions—of the smallest as well as the largest, and windows of very different sizes and proportions to be introduced into the same elevation. For further remarks on this subject the reader may refer to what has been said on Gothic Architecture, p. 324, and Oriel; since we must here confine ourselves to windows in the Italian or modern style generally."

After speaking of the various modes of treating windows according to the floor they occupy in a façade, the writer proceeds with remarks of his own, referring to various examples.

"In the basement of the Strand front of Somerset House, which, although secondary to the order, is almost of equal importance and effect in the general composition, the windows are more than usually decorated, having Doric pilasters, entablatures, and pediments, and their sills resting upon bold consoles or trusses. It is true they are set within arcades, and therefore preparation is so far made for their dressings, which are thus framed in from the rusticated surface, so that their richness does not seem at variance with the latter; the richness itself too is of a bold character. When the ground-floor is not a distinct basement, its windows require to be equally dressed, or very nearly so, with those of the principal floor, with little other difference as to proportion and design than what is necessary for preserving some distinction and avoiding monotonous repetition; because, though it is desirable that all the windows on a floor should be of uniform design, except that a centre window may occasionally be more decorated and rendered a more conspicuous feature than the rest, it is hardly less desirable to avoid the sameness arising from all the windows of a front being too nearly alike. Where the ground-floor is the principal one also, as is now frequently the case in villa residences, in which all the chief rooms are below, and perhaps only a single chamber-floor over them, the lower windows are of course the most important in design; yet, whether the principal or secondary, they ought to be in keeping with the rest of the design. This rule, or rather this law of æsthetic composition, has been admirably well attended to by Mr. Barry in the Travellers' and Reform Clubhouses, London, and, on the contrary, violated in the exterior of Goldsmiths' Hall, where, although there are two ranges of windows included within the same order, and the upper windows are decorated in an unusual degree, almost to excess, those below have no dressings, not even any kind of rusticated borders in lieu of them, but are merely so many plain apertures on a surface scantily streaked with horizontal rustic joints. Accordingly, while the lower division of the front looks poor, and is deficient in boldness, the upper windows seem overloaded with ornament.

"What has been said in regard to the sequence of the different tiers of windows in an elevation, is to be understood only generally, there being many exceptions, and not a few anomalous cases. In the façade of the Palazzo Massimi at Rome, one of Peruzzi's best works, there are two tiers of mezzanine windows above those of the principal floor; in the celebrated Palazzo Farnese, on the contrary, the second-floor windows (which are also the uppermost) are somewhat loftier than the others, at least in their apertures, owing to these last being arched, and are further remarkable as having pediments, which are seldom used for windows higher up than the first-floor. In Sangello's façade of the Palazzo Sachetti, there is a range of mezzanines between the windows of the first and the uppermost floor, and instead of being made principal in the design, the former are considerably less than those of the ground-floor, and are moreover singular as being *Althuerg*—a term applied by some to those doors and windows which are narrower at top than at bottom, as in the Erechtheum. [Door, p. 85.] The façade of the Palazzo Negroni, by Ammanati, is similar in its general character to the preceding, there being a row of mezzanine and square windows between the first and third floor; and it also resembles it in the importance given to the ground-floor windows. In regard to windows of the last-mentioned class, the Palazzo Buoncompagno at Rome, a work attributed to Bramante, offers an unusual example, for there the lower floor and its windows are made the next principal features after those immediately above them: in both the apertures themselves are round-headed, with imposts and archivolts, but flanked by pilasters supporting an entablature, whereby the general form of the *chambranle*, or dressing, becomes square-headed: the chief difference between these two tiers of windows is, that those above have pediments (alternately angular and segmental), while the others have none."

That the writer in the Cyclopædia has not the same horror of small "gables" over windows as Dr. Fulton has, is evident from the following remarks, with which we must close our extracts.

"In addition to the above, there are many other parts which enter into the composition of window-dressings, and among them a principal one is the *pediment*, applied by way of finish to the whole. Some critics have urged objections against pediments to windows, as being contrary to strict propriety: hypercriticism of that kind might be directed against a great deal in every style, on which its particular character and expression more or less depend. It is enough for us that the application of the pediment form to such *purpose* is so fully established that no idea of incongruity attends it, and that, considered with regard to its artistical effect, it contributes to variety in various ways. At the same time we cannot admit as legitimate more than two distinct varieties of it, namely, the *angular*, and the curved or *segmental*: for as soon as we begin to disturb the outline, we violate the principles of the style from which such decorative feature is derived. Broken pediments, scrolled-shaped ones, &c. are therefore to be put into the same category with twisted columns and other extravagances of that kind, which, so far from displaying invention, rather betray sterility of ideas, and the inability to attain originality otherwise than by adopting what the least educated taste rejects as vicious. Even segmental pediments ought to be very sparingly introduced—perhaps only for the sake of variety, in alternation with angular ones, they being in themselves rather heavy in appearance. One great value of the pediment as a decorative feature of windows is, that its sloping lines contrast with those of horizontal mouldings, and occasion variety of outline in the general form of windows; and that such addition serves to distinguish and give due importance to the windows of the principal floor of a building, to which, in good composition, they are generally confined. In the Palazzo Farnese both the upper rows of windows have pediments: the first alternately angular and segmental, the other only angular ones; and there, owing to the very great space over the windows, the numerous pediments do not seem to overload the design, as would be the case if the upper ones were to come nearly immediately beneath the superior cornice. * * *

"We now come to another mode, quite distinct from any of the preceding, namely, that which consists in applying a small order either in columns or pilasters, with a regular entablature, sometimes with the usual architrave also surrounding the aperture of the window, at others not. And though some object to such *mycrostyle* compositions, as being inconsistent with the original purpose of columns, their impropriety is at least redeemed by richness and beauty. At all events, the impropriety is not so great as that of applying small orders successively to the different stories of a building, thereby rendering diminutive, parts which, if introduced, ought to be proportioned to the entire edifice; whereas, in the case of columns to windows, they show themselves to be intended only as decorations, and though really small, yet being distinct and independent features, instead of giving an air of littleness to the entire composition, they rather give greater dignity and importance to the windows. As to the

actual effect produced by them, that depends upon the judgment and taste with which such decoration is applied. Windows of this kind are certainly not suited for any except astylar composition, since if there be also a large general order to the façade, while the columns to the windows look rather insignificant by comparison, there is too much of repetition and monotony, and the whole decoration seems to consist only of columns of different sizes. Still worse is the effect when, as is the case with the Atlas Office, Cheapside, London, the building consists of more than one order, because then, as the windows must be large in proportion to those orders, the columns to the windows cause the others to look petty, and the whole to appear both crowded and confused—a defect most strikingly exemplified in the structure alluded to, nor is it at all decreased by the windows to both the upper floors being columniated. On the contrary, Barry's two clubhouses in Pall-Mall are truly beautiful examples in regard to windows thus decorated; for there they are treated in a most masterly manner, and applied with the happiest effect, and so as to produce a felicitous union of sobriety and simplicity with a very high degree of decoration. Instead of being mere copies, those windows are original and admirably studied compositions, beautifully and even elaborately finished, whereas in the other instance just mentioned, and also in the front of the Clubhouse Chambers, Regent Street, though there are columns to the windows, there is a very sorry entablature to them—neither architrave nor frieze, but merely a plain lintel in lieu of them, without mouldings of any kind, which, besides being offensively lumpish and heavy, look mean in what professes to be decoration of a superior kind."

The article ought to have been more fully illustrated with cuts, and no doubt would have been so, had the writer of it not been at all controlled in that respect.

Glenny's Garden Almanac for 1844. London: R. Groombridge

The Gardener or the Amateur will find much useful information relative to the cultivation of the flower and kitchen garden in this almanac.

The Mechanic's Almanac and Engineer's Year-book for 1844. Published by the Stationers' Company, contains a great variety of statistical and scientific information, collated from various works of the present year.

A Cosmorama View of London. Engraved by J. H. Banks.

This is a novel, and at the same time, an interesting view of the great metropolis, it not only shows the line of streets, squares, &c., but also the elevation of the houses, bridges, and all the public buildings: it is a work of great labour and deserves encouragement.

Polygraphia Curiosa.—Mr. Jobbins, the lithographer, is collecting together the various alphabets of writers of by-gone days; many of them are of a beautiful form and in colours, he intends to publish them in parts, two of which have already appeared; it will be a work of considerable interest, and deserving of support, particularly by the architect.

Davies' Reconnoitering Telescopes are very compact, being only 3½ inches long, an inch diameter, and of great power; they are particularly convenient to carry in the pocket on a ramble or tour.

RAILWAY CHRONICLE OF THE MONTH.

Amalgamation is still the great topic of the day. We closed the last month by announcing the conclusion of the arrangement between the Eastern Counties and Northern and Eastern railways. Since then meetings have been held of the North Union and Bolton and Preston for a similar object. The terms are, that the North Union shall have twice as much per cent upon the amount of their capital as the Bolton and Preston have on theirs, until the dividends to the North Union reach 6 per cent, and the Bolton and Preston 3 per cent, then the remaining profits to be divided equally. The subscribed capital of the North Union is to be taken at £477,539, and of the Bolton and Preston £262,002, the total £730,541. The asserted intention of amalgamation between the Grand Junction, Liverpool and Manchester, and Manchester and Birmingham, is now formally denied. With regard to the Hull and Selby, however, feelers are being put out by Mr. Hudson, and he will no doubt succeed, as he holds out a prospect of 6 per cent. The Newcastle and Darlington have, we may observe, purchased the Durham Junction.

It is again stated that the Birmingham and Glo'ster have offered to sell the Glo'ster end of their line to the Great Western, but nothing certain can be depended on, as to the probability of such a transaction being immediately entered into.

Branch lines and new lines form another leading topic, particularly as the last day for giving notices of applications to Parliament is just past. We will briefly enumerate some of those as to which active measures are in progress. A branch from the South Eastern to Canterbury, Ramsgate and Margate, to be laid with a single line, cost about £300,000. This will be carried into effect. Another branch, the Hastings, Rye, and Tenterden Railway is started by an independent company, but as the parties are quarrelling among themselves and are not strongly backed, nothing is likely to be done. An opposition branch from the Brighton Railway to Hastings has been surveyed; but it is a mere campaigning movement. A line to Salisbury is talked of, and a number of local meetings have been held, but little is known as to the prospects of the project. The Great Western district is principally interested in the Devon and Cornwall line, which has been progressing favourably, but the definitive arrangements have not yet been made. The Great Western company have given notices for a branch to Newbury, and extensions into the railroads of Cheltenham and Glo'ster, showing their intention to consolidate their interest in that direction. The Holyhead line is moving, but is in a precarious state. The Manchester and Birmingham have made the arrangements for the branch to Macclesfield, whether, however, they will take steps as to a southern extension does not yet appear. A mineral line in Furness is well supported, and perhaps a continuation of the Maryport and Carlisle Railway to Whitehaven may be expected. A line is talked of to Blackburn. The £100,000 required from the local interest for the Lancaster, Kendal and Carlisle Railway, has been subscribed, and the other £400,000 will consequently be supplied by the Great Southern companies, and the scheme be prosecuted. A branch in Scotland, from the Edinburgh and Glasgow Railway to Stirling, has been asked for, but its prosecution is by no means certain. The only other proposed lines of interest in Scotland are the continuation of the Edinburgh, Leith, and Newhaven Railway to Granton Pier, and the formation of the line from Edinburgh to Newcastle, called the North British. The completion of these is also matter of uncertainty. A junction between the Newcastle and Darlington and Brandling junction will be carried out. The York and North Midland propose branches to Harrowgate, and to join the Whitby and Pickering. In south Yorkshire and Lancashire, however, the greatest vigour prevails, branches being proposed from the Manchester and Leeds, Sheffield and Manchester Railways to Ashton, Huddersfield, Chesterfield, and numerous other places.

In the eastern districts a line is proposed from Blackwall to Tilbury, being a resuscitation of the Thames Haven; but the other lines proposed depend upon the ultimate arrangements of the new Eastern Counties amalgamations. Such is the case with the Eastern Union, Harwich, Norwich and Brandon, &c.

A very curious meeting took place at Sunderland of the Durham and Sunderland company, which was for the purpose of removing a gentleman from the directors, whose proceedings very closely resembled those of a man *non compos*. The resolutions were carried unanimously.

The Bricklayers Arms branch is going on with rapidity, and will, it is expected, be ready by the Spring.

The Maidstone branch is announced to be ready by September of next year.

The South-Eastern half-yearly meeting took place on the 15th. All the works were declared to be getting on well, and all contractors accounts settled up, a fact which does great credit to Mr. William Cubitt. The traffic had got on well, but it was considered premature to declare a dividend. The Brighton accounts are still unsettled, they were said not to be satisfactory, and the Directors of the South-Eastern Railway showed no disposition to settle without some beneficial arrangement being made for their company.

THE AMSTERDAM AND ARNHEIM RAILWAY.

RHYN SPOORWEG.

The *Journal des Chemin de Fer* contains an account of this line, of which we have availed ourselves to give the following particulars. This railway proceeds from Amsterdam to Arnheim by Utrecht, and is in communication with the Amsterdam and Rotterdam Railway. It is intended to be put in connexion with the Prussian Railway. It is in an advanced state, an experimental trip has been made on 8 miles of it, and it is intended to open for traffic towards the end of the year, a section 22½ miles long between Amsterdam and Utrecht. In the course of next year it is expected that the whole of the line to Arnheim will be completed, being a distance of 56 miles. The line is laid out with very good gradients, without any violent curves. The maximum inclination is 1 in 300. The distance between Amsterdam and Utrecht is laid out in three lines only, united by curves of about 270 yards

radius, and some minor curves on approaching the Utrecht station. The soil through which the line passes is generally a thin stratum of mould of about a foot thick, under which is a kind of light turf. Sand for forming the embankments had to be got from a distance of some leagues from the dunes or sand-hills. The embankments vary from a yard to 4 yards in height, and are carried down to the natural soil of the polders or marshes. In the parts which are least solid, being a distance of 6 miles, the embankment, entirely of sand, rests on a bed of fascines 11 yards wide, and about 2 feet thick. Notwithstanding this precaution many slips took place. This want of consistency or firmness, of the ground is indeed one principal reason why the original engineer Mynheer D. H. Goudridan, adopted a gauge of 2 metres (6ft. 6½in.) with rails of 25 to 30 kilogrammes per metre run (about 60 lbs. per yard), supported on a continuous framing of Baltic pine, of which the longitudinals are from 7 to 12 inches square, and the cross-sleepers placed a yard apart are from 6 in. to 12 in. square, with a length of 3 metres (about 3 yards). For the same reason this system has also been adopted on the Amsterdam and Rotterdam railway. However extensive this framing may be, it was necessary to use it to obtain a firm way for heavy trains. The country being a level there are no sensible slopes, but as the canals (large and small) frequently intersect, the engineers have been obliged to form a number of bridges and aqueducts, among which are three large swivel bridges of cast iron made at the Hague and two draw-bridges. The others are fixed wooden bridges, with abutments in masonry (? brick). All these works of art, as well as the Amsterdam stations, are built on piles. From Utrecht to Arnheim the road goes through a rougher country, and passes several heaths, requiring cuttings, of which five or six have a depth of from 30 to 65 ft., sometimes extending over a length of 300 yards. The total quantity of cutting is about 3,000,000 cubic yards, which has to be carried a mean distance of about two miles. In general the cuttings are in mere sand mixed with loose pebbles. The inclination of the slopes, 36 to 50 feet high, is 15 degrees, and they are covered with heath sod (? grass sod). After standing two years it has been found that the rains have not at all affected the embankments. Between Utrecht and Arnheim the road is laid out with much the same kinds of curves and straight lengths as in the previous part, and among the works are a large cast iron swivel bridge, broad enough to carry two lines of rails, some smaller bridges in cast iron, and a number of occupation bridges, viaducts and culverts.

The act for this company was granted in 1838, and the capital was raised under the personal guarantee of 4½ per cent. by the ex King Wm. 1st., he dividing with the shareholders the surplus profits. The direction of the works was entrusted to the government engineers, who, on account of the state of the law, had great difficulty in getting possession of the land, and settling with the landowners. Their difficulties were such that towards the end of 1842, they were still at law with a great number of them, and unable to prosecute the works with efficiency. Indeed, it was not till last Spring that all the landowners were pacified—then the works were proceeded with at a rate almost unprecedented in foreign engineering enterprises, under the guidance of the present engineer, M. Vanderkun. The estimate for the whole line, 60 miles long, £810,240, and it is not expected that the excess expenditure will be more than 3 or 4 thousand. The line is, for the most part, laid out for a single way—a double way being laid only on 6 miles between Amsterdam and Utrecht, and 6 miles between Utrecht and Arnheim. Sidings are, of course, provided at the several stations. All the bridges and other works of art, are laid out for a double line, which will be laid down throughout where the extent of the traffic may require it.

The working plan consists, at present, of 6 locomotives, made by Sharp and Roberts, of Manchester, and 4 made at Amsterdam. They are all six-wheelers, with driving wheels of 6 ft. 6 in. Six locomotives on Robert Stephenson's new patent have also been ordered of Messrs. Van Vlissengen and Co., of Amsterdam. The number of passenger carriages and goods trains is now seventy, and will be next year one hundred and forty; they have been manufactured in the neighbourhood of Utrecht, and are all six wheels with flanges. All the engineers are Dutchmen.

NEW INVENTIONS AND IMPROVEMENTS.

NAPIER'S PATENT COPPER CLOTH.

A new material under the above name has lately been brought under our notice, which, as it promises to be, ere long, in very general and extensive use, we propose giving some account of it to our readers. It consists of stout linen cloth, on one side of which has been deposited, by electricity, a thin covering of copper, fibres from which, interlacing with those of the cloth, bind the whole firmly into one mass. The minute quantity of metal requisite to form a perfectly covered water-tight texture may be judged from this fact, that a square yard when perfect, weighs only 18 ounces; the cloth itself weighs 6 ounces, consequently 12 ounces of copper is sufficient to coat thoroughly a square yard of cloth; whilst the thinnest rolled copper at present in use weighs about 4½ lb. per square yard. The thickness of the metal, however, may be varied at pleasure, according to the purpose for which it is required. This production is the result of another beautiful application of electro-metallurgy—an art which, no sooner had it issued from the hands of the man of science as a mere experiment, than it stepped with giant strides into our arts and manufactures, and is now extending and ramifying itself in all directions, at one time gilding a pin, at another coppering a ship's bottom, or multiplying indefinitely the delicate lines of the engraver.

The mode of manufacturing the copper cloth is as follows: on to a sheet of copper paste, very evenly, with as little paste as possible, stout linen cloth; and when thoroughly dry, attach it to the negative pole of a galvanic battery, and immerse it in a solution of sulphate of copper connecting a piece of copper to the positive pole to be dissolved. Decomposition takes place, copper is thrown down on the cloth, and, endeavouring to reach the copper plate, insinuates itself into all the pores of the cloth, forming one perfect whole. The time requisite will vary according to the thickness required, but in general five or six hours is quite sufficient to give a good coating. But a battery is by no means essential, as, by the following means, it may be dispensed with. Attach the copper, with the cloth pasted on it, to a sheet of amalgamated zinc, round which has been wrapped a stout piece of brown paper, with the ends sealed down, so as to form a kind of bag: immerse the whole into the solution, and a deposit immediately takes place, zinc being dissolved, and a nearly equal weight of copper deposited. This is a very cheap and simple method, and is well worthy the attention of the electrotypist. The sulphate of zinc formed remains within the paper bag, and very little of the copper solution finds its way into it. If the copper does not spread fast enough on the cloth, it may be rendered a better conductor of electricity by rubbing it over with a little blacklead, or what is better, a new conducting material, produced by heating pieces of zinc and iron together, to a heat a little below that at which the zinc sublimes; a crystalline compound is formed, which can be reduced to a very fine powder, and may be used either alone or with blacklead; when alone, it should be used with something adhesive; glycerine has been found to answer perfectly.

The process is not confined to covering the surface all over, as by cutting the underneath copper into various shapes, devices of any kind may be struck into the cloth, which, being afterwards silvered or gilt, produces a very beautiful effect.

The numerous applications of this useful material will suggest themselves to the reader, not only for out-door works, such as for covering roofs, verandahs, &c., on account of its lightness and water-tightness, but also for ornamental purposes within doors; and we feel sure that it has but to be well-known to be very generally adopted.

NEW LIGHT.

It is now four years since the first experiment on the subject of rendering continuous, and fixing at a given point, the electric fluid, and making it applicable to the general purposes of lighting was made in Paris, but the discoverer was not able to induce any person to advance even 1,000l. for an apparatus on a sufficiently large scale for a public experiment. A public experiment was made at the Place de la Concorde, in the presence of the authorities, and from four to five thousand of the inhabitants of Paris, on the 20th inst. On one of the bases of the statues at the Pavilion de Lille, a glass globe of apparently twelve or thirteen inches diameter, with a moveable reflector, was fixed in connexion with a voltaic battery, and at a little before nine o'clock the electric fluid was thrown into it by a conductor. At this time all the gas lights in the place, about 100 in number, were burning. As soon as the electric light appeared, the nearest gas light had the same dull, thick, and heavy appearance as oil lamps have by the side of gas. Soon afterwards the gas lights were extinguished, and the electric light shone forth in all its brilliancy. Within 100 yards of the light it was easy to read the smallest print; it was, in fact, as light as day. The astonishment of the assembled multitude was very great, and their delight as strong as their astonishment. The estimate made by scientific persons who were present, was that the electric light was equal to twenty of the gas lamps, and, consequently, that five of these lights would suffice to light the whole place most brilliantly. As regards the expense of production, nothing positive has transpired, but it would be considerably less than that of the generation of gas, whilst the first outlay for machinery and conductors would not amount to a twentieth part of that required for gas-works. There would also be another great advantage in the electric light. It gives out no bad smell; it emits none of those elements which, in the burning of gas, are so injurious to health, and explosion would be impossible. The only danger would be at the battery itself, but that would be under the control of competent persons; and, even in this respect, there would be no danger, even to unskilful persons, with an apparatus of moderate size. Internal lighting would be as practicable as external lighting, for by conductors the fluid would be conveyed to every part of the house. This experiment was with a voltaic battery of two hundred pairs, composed as follows:—1st, an outer globe of glass; 2ndly, in this globe a cylinder of charcoal, open at both ends, and plunged in the nitric acid contained in the outer globe; 3rdly, in the charcoal a porous porcelain vase, containing acidulated water (with sulphuric acid)—this replaces the cloth in the common battery; 4thly, in the porcelain vase a cylinder of amalgam of zinc plunged in acidulated water. The pile was on the Pavilion de Lille; the two copper conductors from the two poles, and pointed with char-

coal, lead to an empty globe from which the air has been exhausted. The two fluids on meeting produce a soft but most intense light. The experiment was considered highly successful by the authorities who were present, and it is to be repeated on a larger scale. Should the thing work as well as in a general way as it did last night, and the cost be less than that of gas, which it must be, there will be a dreadful revolution in gas works. A company for supplying the electric light would realize a handsome profit on charging only a sixth of what is now paid for gas. The strength of the electric light did not appear to exceed that of the hydro-oxygen; but then how much more simple is the apparatus; how much less costly the expense of production! The hydro-oxygen light requires a double and most expensive apparatus, and is only applicable to a few localities; the electric light may be applied externally and internally in any place.

[The above description, copied from the French Journals, has been inserted by many English papers, without comment, like several other paragraphs of *new* and *wonderful* inventions, which, if we are to believe them, are to supersede the present arrangements; and yet, from that time forward, we never hear anything more of them, they having been proved to be either perfectly impracticable, or, as is our opinion in the present instance, far more expensive than that which is already *in use*; conclusions to which every reader could arrive at once, if the whole of the evidence were given instead of only that portion which just suits the inventor or projector to give. Although we consider that the consumption of nitric and sulphuric acids and zinc, in 200 cells of a battery, would cost much more than the gas requisite for the 20 lights which it is said to be equal to, we cannot state so for certain without more data. But what we find most fault with is, the stating that to be new, which has no novelty about it, and which every tyro in galvanism has himself performed. The battery is an ordinary Grove's arrangement with charcoal substituted for the platinum, an improvement which was made immediately after Grove's first announcement, and of which the younger Silliman has long ago published a very simple arrangement. The *new* light produced thereby between the charcoal poles, is almost as old as the science itself, and is described in every treatise on the subject. Besides which, in connexion with a cheaper battery, the whole process has been patented in this country with much better arrangements, and has not been carried out, we suspect, on account, of the increased expense over gas. As to the bad smell being given off, there certainly is not at the light itself, but at the proposed battery there are nitric acid fumes given off, which are not only offensive, but highly corrosive to anything it comes near, animal, vegetable, and mineral. It would be requisite to keep it in a place by itself, if used in houses, as proposed, and then comes the increased resistance to the current produced by length of conducting wires. Although [illegible] sp[illegible]d to [illegible] pl[illegible]sible scheme fo[illegible] [illegible] cheapening public lighting, we cannot, in the present instance, see much to give us hopes of its success. At all events, we wish it to be stripped of a claim which it does not possess, viz., untried novelty—and to place it in the light of an experiment for public adoption, that which has been long known and conducted both in the laboratory and at the lecture table.—Editor C. E. & A. Journal.]

NEW MANUFACTURE OF LIME.

Patented by Messrs. Daniell and Hutchinson, May 4, 1843, Specification enrolled, November 4, 1843.

Lime is at present usually manufactured from limestone, or chalk, or other substances in which it exists in an indurated state, or state of solid combination with other bodies. The nature of Messrs. Daniell and Hutchinson's invention consists in their having discovered that there are large tracts of sand on the coasts of this kingdom, and particularly on the coasts of the county of Cornwall, which are at present either treated as valueless or made use of, like other sand, for purposes of mechanical intermixture merely, as in the making of mortar, breaking up of tenacious soils, &c.; but from which, nevertheless, lime of an excellent quality, applicable to building, agricultural, manufacturing, and other purposes, can be manufactured in large quantities. The patentees state that they have ascertained, "by numerous and careful analyses of the sand referred to, that it usually contains more than 70 *per cent. of carbonate of lime.*" The mode of reduction which they adopt is thus described.—"In the *first* place, in order to test whether the sand on which we propose to operate is of the proper quality, we put an ascertained quantity into a retort, and pour dilute muriatic acid upon it; if it contain carbonate of lime, a violent effervescence ensues, and carbonic acid is rapidly evolved (the presence of which may be readily detected by its reddening litmus paper.) We then neutralize the muriatic acid by the addition of liquid ammonia, and precipitate the lime by adding the carbonate of ammonia in excess. We next weigh this precipitate, which gives us a measure of the average quantity of lime which may be extracted from larger quantities of the sand of which that experimented upon was a sample. If the weight of the precipitate is from six to eight tenth parts of the original weight of sand tested, then the sand is of a proper quality for the purpose of our manufacture; but if much under that, the product will in some places not be sufficient to defray the expenses of reduction. In manufacturing the lime on a large scale, we proceed as follows:—we make use of reverberatory furnaces, varying in size according to the quantities operated upon, but the bodies of which are generally from 20 to 30 feet in length, from 6 to 10 feet in their greatest width, but gradually contracted towards the end, where they open into the chimney, and from 15 inches to 2 feet in height. The sand is laid upon the bed of the furnaces to the height of the bridges, which are made a little higher than usual, in order that they may protect the sand from being blown forward by the direct action of the current of flame upon them. The high degree of heat to which the sand is here exposed expels the carbonic acid so quickly, that in about two hours the process of conversion is generally perfected. The lime is then withdrawn from the furnace through doorways made at intervals, either in the sides, end, or bottom, for that purpose. It is now in a proper state to be employed as a manure; but to fit it for the various other purposes to which it may be applied, we first pass it through fine sieves to separate any extraneous substances which it may contain."

When it is desired to convert the lime so obtained into hydrate of lime, the patentees add the necessary equivalent of water; if into sulphate of lime, or gypsum, they add the necessary equivalent of sulphuric acid; and so on through all the various combinations of which lime is susceptible.—*Mech. Mag.*

MISCELLANEA.

North Shields.—The Old Gas Company. The North Shields Gas works have resolved to divide their capital stock into 1300 shares of 5*l.* each, and to allot them in lots of not more than 10 shares each to gas consumers and reduce the rates of burners and of gas to 7*s.* per 1000 ft. from January 1st. 1844. The New Company "Borough of Tynemouth Gas Co." in which 1595 shares are taken by consumers, and 433 by non-consumers, offer to take the prices the old company have reduced them to in Oct. 1841. The old company was established in 1821, and the new company assert that up to 1831 they were receiving $12\frac{1}{2}$ per cent. more than companies generally. Feeling runs very high, and whether the truth of the adage of "two of a trade" will be verified, time will show.

Case of Laws as to opening out New Window Lights.—At an adjourned quarter sessions held at Guildhall, Newcastle-on-Tyne, October 30th, to decide a dispute as to compensation to be paid to an individual by the corporation for setting his house back on a line with the other buildings. His house projected before the adjoining house to the extent of $5\frac{1}{2}$ feet. The adjoining house was set back by the corporation thirty years ago. The counsel for the defence said.—"If Mr. - had a right to windows in the side wall, why had he never had them there before. The fact was, that he could not put out windows overlooking another person's property, and if he had made windows in the side wall, the corporation, or the person whose property was overlooked, could screen them up and obstruct the light. The plaintiff had no right to ask compensation for a side frontage that did not belong to him, and that he would not be permitted to have." The Recorder in summing up said, "that there was only one point of law to which he would direct the attention of the jury, which was, the right to put out windows on the flank wall. He was of opinion the proprietor had not the right to do so and, therefore, whatever benefit they might think would arise to the property from having this additional light must be left out of the account in awarding damages." It was a special jury case, and the offer of the corporation was 150*l.* the sum claimed was 900*l.* and the verdict 225*l.* The setting back of the property was compulsory under the powers of a town improvement act

Newcastle-on-Tyne.—There are now three projects for a high Level Bridge at Newcastle, at least notices of intended application to Parliament have been given, but the site as proposed by Mr. Green is that sanctioned by Mr. Hudson, and Mr. Geo. Stephenson, the other two are by Mr. Grainger and the Carlisle and Brandling Junction Railway.

Chatham, Nov. 10.—The Admiralty have given directions for metal mills to be erected in this dock-yard, similar to those at Portsmouth, for the purpose of supplying the eastern yards with copper bolts and sheets of copper. It is also rumoured that the Admiralty have it in contemplation to enlarge the yard, and also to make a large wet-dock for the reception of first-class ships. The Watt steam-frigate is fast progressing, owing to the number of hands on her.

Flat Roofs.—Mr. Loat of Clapham, builder, has lately obtained a patent for what he calls an improved mode of constructing floors and roofs, which are formed by a series of hollow vessels of earthenware, that have been use for many years in forming arches; but instead of laying them with a curve, Mr. Loat lays them flat on boards and combines them together with cement, and when the roof or floor is completed and the cement set, the boards are removed; the upper surface is covered with flat tiles or slates bedded in cement. The under surface he states, can be lathed with iron laths or hoops, and plastered over with lime and hair; why not dispense with the laths, would there not be sufficient key for the plastering without?

Paper Cloth.—Mr. Chapman of Arundel-street, Strand, lately obtained a patent for covering one or both sides of any fabric, such as canvas, muslin, calico, or linen, with paper suitable for writing, printing, or drawing; it is made by pressing the pulp on the fabric with a solution of gum, glue, or other adhesive material, and passing it between rollers, by which means the cloth and paper are firmly united.

THE IRON STEAMER NIMROD.—This iron steamer, built by Messrs. Thomas Vernon and Co., for the Liverpool and Cork station, took her trial trip on Thursday the 23d ult., proceeding several miles out to sea, and performing in the most admirable manner. There was none of the usual vibration perceptible from her engines, which were manufactured by Messrs. Bury, Curtis, and Kennedy, and it is remarkable that although they occupy so much less space than the ordinary side lever engines, as to leave 10,000 feet more capacity in the holds, they worked to a speed which has already stamped her as a fast-sailing vessel. It is a fact worthy of being recorded, that her keel was only laid on the 6th of May, and she is now ready for her destined voyages—a vessel of 600 tons burthen, and 300-horse power.—*Liverpool Mercury.*

NEAPOLITAN STEAMER. On Saturday the 18th ult., the war-steamer *Roberto*, built in this country for the Neapolitan Government, made her trial trip from Blackwall to Gravesend, which she performed admirably. The revolutions were 21¼ per minute, and her speed rather more than 12 miles an hour. Her tonnage is 1,056, horse power 300, length 190 feet, breadth 34, depth of hold 19. Her reported armament is two large swivel guns, to carry hollow shot, and four 32-pounders. She is the last of the four ordered, and will leave shortly for Naples. She was built by Mr. Pritchard, of Northfleet, and her engines were made by the patentees, Messrs. Maudslays and Field. They are the double cylinder engines. The *Roberto* bears a close resemblance to the five war-steamers built and fitted with engines (by the same parties) for the Russian Government some time since.

IRON KEEL PLATES. -Mr. Boydell, of the Oak Farm Works, Staffordshire, has obtained a patent for forming keel plates, by rolling instead of hammering, by taking two pieces of angle iron for the sides, and a flat plate for the bottom from 7 to 9 feet long, which are held together by wooden cramps, and then placed in a furnace and heated to a welding heat, by this means the cramps are consumed, and the edges of the metal are melted just sufficiently to unite the three pieces; they are then taken from the furnace and passed between rollers, of the requisite form of the keel for securely welding them together.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM OCTOBER 27 TO NOVEMBER 21, 1843

Six Months allowed for Enrolment, unless otherwise expressed.

Jonathan Bell, jun., of Abbey-street, Bethnal green-road, trimming manufacturer, for "*improvements in machinery for manufacturing elastic braid.*"—Sealed October 27.

Alonzo Grandison Hull, of Clifford-street, Bond-street, doctor of medicine, for "*improvements in manufacturing or improving fermented and distilled liquors.*"—October 27

John Kibble, of Glasgow, gent., for "*improvements in apparatus for propelling vessels.*"—Nov. 2.

Matthew Leach, of Manchester, mechanic, for "*improvements in rotary steam engines, which improvements are applicable to pumps for lifting and forcing water.*"—Nov. 2.

Joseph Dickinson Stagg, of Middleton, in Teesdale, Durham, manager of smelting works, for "*a new and improved plan for collecting, condensing and purifying the fumes of lead, copper, and other ores and metals, also the particles of such ores and metals arising, or produced from the roasting, smelting, or manufacturing thereof, and also the noxious smoke gases, salt and acids, soluble and absorbable in water, generated in treating and working such ores and metals.*"—Nov. 2.

David Evans, of Coleshill-street, Eaton-square, engineer, for "*improvements in sweeping and cleansing chimneys and flues, and in increasing the draft therein, and in preventing the soot from smoking.*"—Nov. 2.

Joshua Proctor Westhead, of Manchester, manufacturer, for "*a new or improved fabrics, or new and improved fabrics, and also certain additional forms of machinery for making the same, which modifications of machinery are applicable to the manufacture of woven fabrics.*"—Nov. 2.

Frederic Isaac Welch, of Birmingham, manufacturer, for "*an improvement or improvements in the manufacture of leather.*"—Nov. 2.

Robert Davison, of Brick-lane, Spitalfields, civil engineer, and William Symington, of East Smithfield, civil engineer, for "*a method of cleansing, purifying, and sweetening casks, vats and other vessels.*"—Nov. 2.

William Edward Newton, Chancery-lane, civil engineer, for "*improvements in furnaces or fire-places.*" (A communication.)—Nov. 1.

Robert Raynsford Jackson, of Blackburn, cotton spinner, for "*improvements in the machinery or apparatus to be used in the preparation of cotton and other fibrous substances for spinning.*"—Nov. 4.

Pierre Armand Lecomte de Fontainemoreau, of Skinners'-place, Size-lane, London, for "*an improved crane called 'Dynamometric.'*" (A communication.)—Nov. 4.

William Rowan, of the firm of John Rowan and Sons, of Doagh Foundry, Antrim, engineer, for "*improvements in axles.*"—Nov. 7.

Benjamin Parsons, of York-road, Lambeth, engineer, and Edward Esdaile, of the City Saw Mills, City-road, machine sawyer, for "*an improved machine for cutting leaves of wood, such as those commonly called "scale board.*"—Nov. 9.

Charles Drury Hazen, of Nottingham, merchant, for "*improvements in machinery for knitting stockings and other articles.*" (A communication.)—Nov. 9.

Arthur Dunn, of Rotherhithe, soap-boiler, for "*improvements in the manufacture of soap.*"—Nov. 9.

William Bush, of Union-street, Deptford, engineer, for "*improvements in rendering magnetic needles less prejudicially influenced by local attractions.*"—Nov. 9.

Thomas Clarendon, of Great Brunswick-street, Dublin, gent., for an "*improved method of shoeing horses.*" (A communication.)—Nov. 9; two months.

Samuel Archer, of Rochdale, flannel manufacturer, for "*improvements in the manufacture of flannel.*"—Nov. 9.

Walter Hancock, of Stratford, Essex, engineer, for "*improvements in the manufacture of caoutchouc and caoutchouc in combination with other substances, and in machinery or apparatus for preparing caoutchouc and other materials.*"—Nov. 9.

George Holmes, of Stroudwater, engineer, for "*improvements in furnaces or fire places.*"—Nov. 9.

Samuel Heseltine, jun., of Bromley, Middlesex, engineer, for "*improvements in engines to be worked by air or other gases.*"—Nov. 9.

William Edward Newton, of Chancery-lane, civil engineer, for "*improvements in machinery for preparing and combing wool, hair, and other fibrous substances.*" (A communication.)—Nov. 16.

John Withers, of Smethwick, Stafford, manufacturing manager, for "*an improvement or improvements in the manufacture of glass.*"—Nov. 16.

Luke Smith, of Manchester, mechanic, for "*improvements in, or applicable to, looms for weaving various kinds of fabrics.*"—Nov. 16.

Edward Buxton, of Basinghall-street, merchant, for "*improvements in spinning wool, cotton, and other fibrous materials.*" (A communication.)—Nov. 16.

George Scott, of New City Chambers, Bishopsgate-street, London, gentleman, for "*improvements in the manufacture, purification, and combustion of gas or gases.*"—Nov. 16.

James Smyth, of Peasenhall, Suffolk, machine maker, for "*improvements in the construction of drills for sowing grain, seeds, and manure.*"—Nov. 16.

George Gwynne, of Putney, gentleman, and George Fergusson Wilson, of Belmont, Vauxhall, gentleman, for "*improvements in the manufacture of candles, and in apparatus for, and processes of treating fatty and other substances for the making of candles, and other uses.*"—Nov. 16.

Ramsay Richard Pennagle, of Howland-street, civil engineer, for "*improvements in applying atmospheric air as a motive power.*"—Nov. 16.

Arthur Wall, of Bisterne-place, Poplar, surgeon, for "*improvements in the manufacture of iron.*"—Nov. 18.

James Roose, of Birmingham, gentleman, for "*an improvement or improvements in the mode or method of manufacturing gun barrels and ordnance.*"—Nov. 18.

William Shepherd, of Kingston-upon-Hull, joiner and builder, for "*an improved four port slide-valve, and an improved controller for reversing steam-engines, and for working the steam expansively in the cylinder.*"—Nov. 18.

Edward Eliott, of the Tower Royal, engineer, for "*a means of adding power to the steam engine, and other machinery.*"—Nov. 18

Moses Poole, of Serle-street, gentleman, for "*improvements in the manufacture of parts of knives and other cutting instruments.*" (A communication.)—Nov. 18

Edmund Snell, of Bridge-road, Lambeth, Surrey, medical student, for "*improvements in the manufacture of soap.*"—Nov. 21.

Thomas Hancock, of Goswell-mews, Goswell-road, waterproof cloth manufacturer, for "*an improvement or improvements in the preparation or manufacture of caoutchouc, in combination with other substances, which preparation or manufacture is suitable for rendering leather, cloth, and other fabrics waterproof, and to various other purposes for which caoutchouc is employed.*"—Nov. 21.

John Coope Haddan, of Liverpool-street, King's-cross, engineer, for "*improvements in the mode of manufacturing papier mache, and other articles made of vegetable pulp.*"—Nov. 21.

William Palmer, of Sutton-street, Clerkenwell, manufacturer, for "*improvements in the manufacture of pills.*"—Nov. 21.

Octavius Dillingham Mordaunt, of Clifford-street, Bond-street, gentleman, for "*improvements in apparatus for obtaining the profile of various forms or figures.*" (A communication.)—Nov. 21.

Moses Poole, of Lincoln's-inn, gentleman, for "*an improved machine for towing or propelling vessels, which can also be used as a boat.*" (A communication.)—Nov. 21.

Antonio Francis Jean Claudet, of High Holborn, glass merchant, for "*improvements in the process and means of obtaining the representation of objects of nature and art.*" (A communication.)—Nov. 21.

Francis Higginson, of the town of Rochester, Lieutenant in the Royal Navy, for "*improvements in fastenings for part of ships and other vessels, which improvements are also applicable to other building purposes.*"—Nov. 21.